101

Syllabus

TECHNOLOGY FOR HIGHER EDUCATION

JUNE 2004 • VOL. 17, NO. 11

A 101communications Publication

The 21st Century Chalkboard

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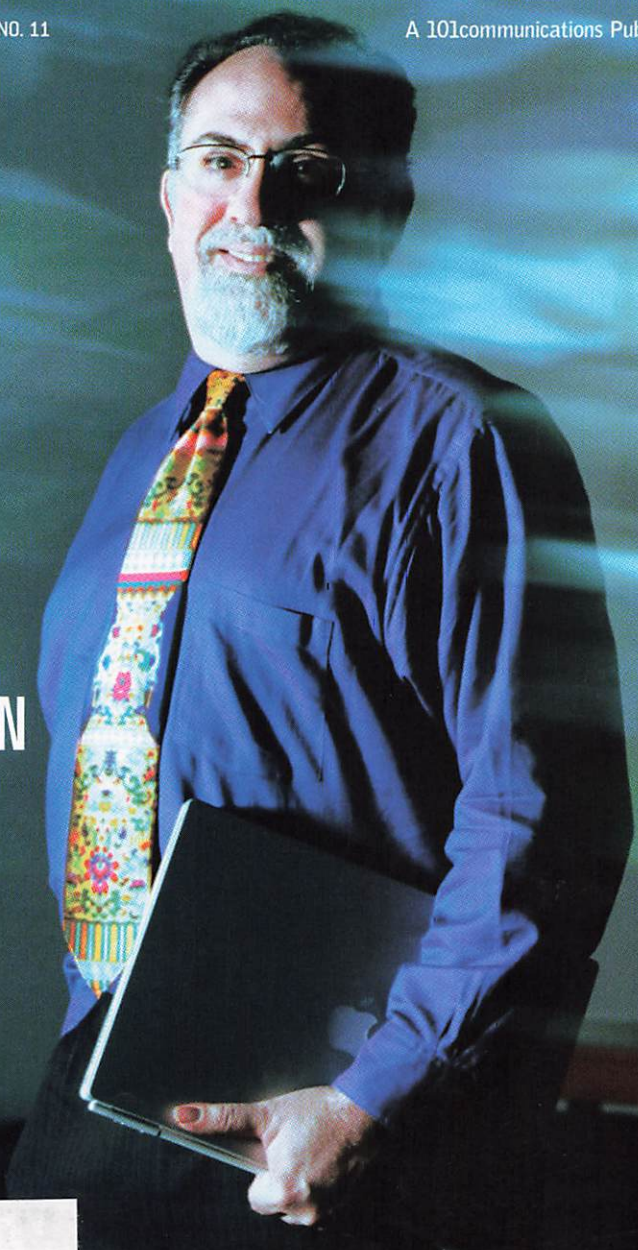

James Oliverio, Professor and Director
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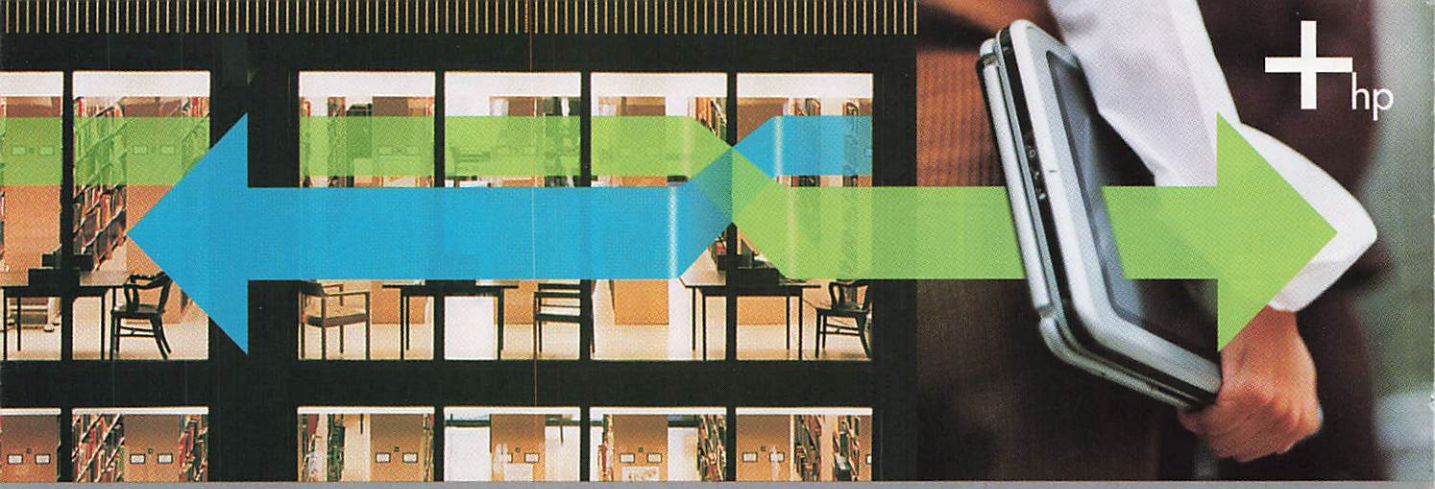

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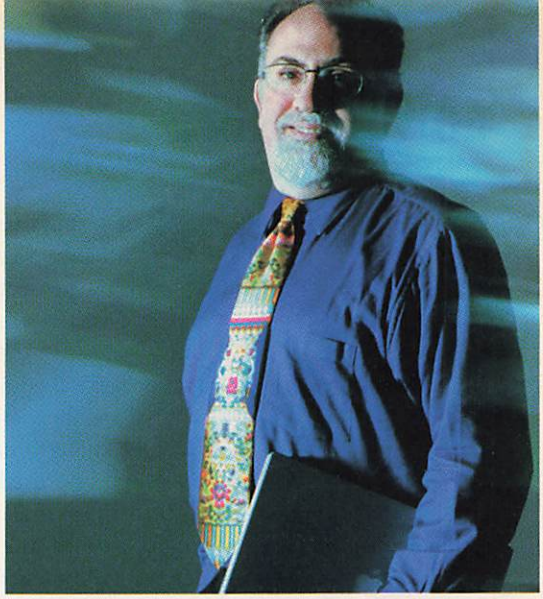

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Photograph by Preston Mack

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An Interview with James Oliverio

Digital Worlds Institute, University of Florida

The latest presentation technologies, new media, and collaboration tools have come together at the REVE, the high-tech Research, Education, and Visualization Environment at the University of Florida's Digital Worlds Institute. Multipoint telecollaborations are connecting faculty and students from different disciplines within the university and around the world. With a 52-foot screen and flexible space configurations, the facility serves projects ranging from class meetings to large-scale artistic productions.

22 **The "Newest Media" and a Principled Approach for Integrating Technology into Instruction**

Joel Smith and Susan Ambrose

Carnegie Mellon University

At Carnegie Mellon University, the use of new media in instruction is informed by the cognitive and learning sciences. CMU's Eberly Center for Teaching Excellence coordinates with the Office of Technology for Education to encourage faculty to think critically about their uses of instructional technology. Here, Joel Smith and Susan Ambrose share seven fundamental questions that can help assess a proposed pedagogical strategy. Examples from CMU's Open Learning Initiative show how applications of new media can meet these "cognitive desiderata."

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31 **Beyond PowerPoint: Building a New Classroom Presenter**

Richard Anderson, University of Washington

A long-standing criticism of PowerPoint is that highly stepwise, linear presentations limit the spontaneity of instruction and interfere with interactions between faculty and students. But that may be changing: Efforts like Classroom Presenter at the University of Washington illustrate how pen annotations and other dynamic features can be incorporated into presentation technology for the classroom.

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EDITOR'S NOTE

Mary Grush, Editor

A few short years ago, the technology of choice to enhance classroom presentation would have been a data projector and screen for displaying a text outline at the front of the room—an incremental improvement over the chalkboard. And while PowerPoint and projection equipment are still staples of instructional technology, the view from your students' chairs has, more recently, changed dramatically. New media, collaboration tools, and improved presentation software have converged to turn those linear, sequential presentations into more spontaneous, interactive sessions. It's easy to grumble about "yet another static, dry, stultifying PowerPoint presentation." But people aren't just complaining. They're determining the best instructional uses of current and emerging classroom technologies, and things are changing fast. In this issue, we hear from campus technology leaders who are working on different elements of what could be considered the "21st Century chalkboard."

At the Digital Worlds Institute at the University of Florida, James Oliverio has pioneered and demonstrated the use of new media in highly interactive telecollaborations. The sessions, done in a facility called the Research, Education, and Visualization Environment (REVE), have the power to bring diverse groups together for complex, media-rich exchanges in real time. In our lead feature interview (page 10), Oliverio comments that "[The technology will] give us a sense of cultural perspectives from people around the world that we would not have had otherwise, regardless of how many books or Web sites we've read."

Instructors need not design the technology components of their courses in isolation. At Carnegie Mellon University, the Office of Technology for Education and the Eberly Center for Teaching Excellence draw on a body of research to help faculty make informed choices about their uses of instructional technology, based on the cognitive and learning sciences. In "The 'Newest Media' and a Principled Approach for Integrating Technology into Instruction" (page 22), Joel Smith and Susan Ambrose review some of the key questions faculty are encouraged to ask themselves as they decide when and how to use technology in their classrooms.

No one wants to feel limited by the very technologies that are supposed to support classroom presentation. In "Beyond PowerPoint: Building a New Classroom Presenter" (page 31), Richard Anderson explains the ideas behind the work he began at Microsoft with the ConferenceXP Project, authoring an advanced presentation system which he later refined and implemented at the University of Washington. The system features digital annotations on a Tablet PC and offers a more flexible environment for student/instructor interaction—these are certainly attributes of the "21st Century chalkboard."

Enjoy this issue of *Syllabus*!

Mary Grush

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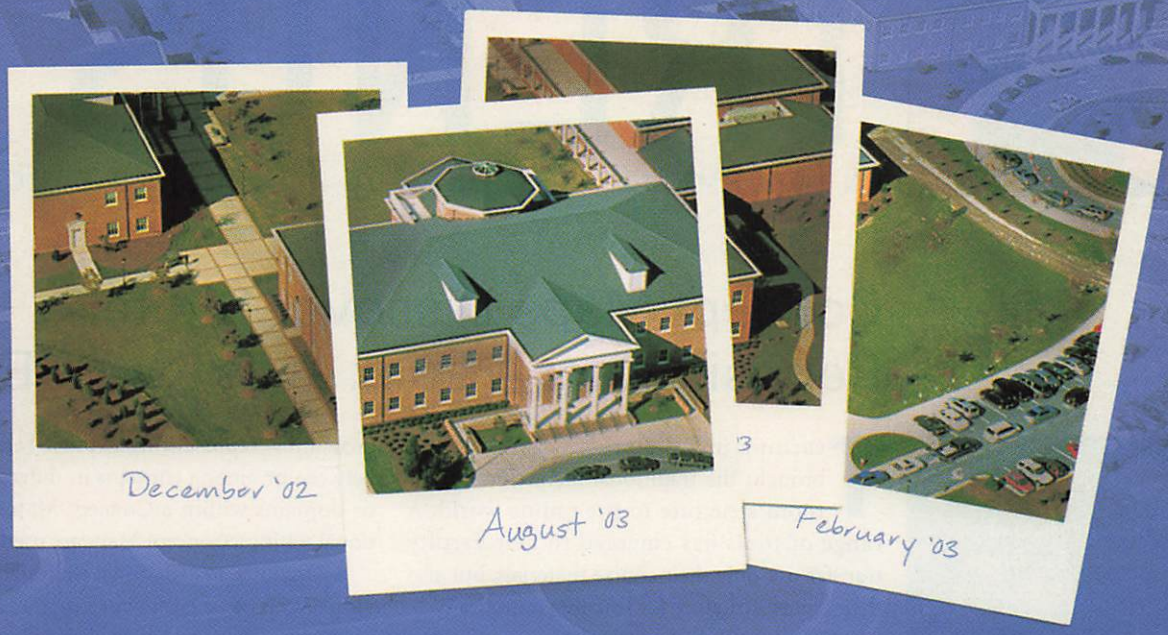

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Phillip D. Long

TRENDS

AN INFORMATION RESOURCE OF INTEREST TO EDUCATORS

Concept Maps Discover Digital Repositories: A Look at Tuft's VUE

BRIEFS

- The **University of California San Diego** (UCSD) is opening a non-profit institute to develop "trustworthy" open source IT architectures and solutions to benefit life sciences and health.
- **Villanova University** has plans to upgrade its campus-wide wireless system to handle voice, data, and messaging. The new system is to be supplied by **Cingular Wireless**.
- **The Higher Education Wireless Access Consortium (HEWAC)**, together with wireless Internet purveyor WiSE Technologies announced rules for colleges that would like to apply for one of 10 grants being given to provide campus wireless networks to colleges.
- **Oral Roberts University** is launching an electronic portfolio system designed to collect student performance data.

For these and other news stories, or to subscribe to our eNewsletters, Syllabus News Update, eLearning Dialogue, and Syllabus IT Trends, visit www.syllabus.com.

Teaching in a digital environment has brought the traditional hierarchical classroom structure to the online world. A range of tools has emerged to help faculty transfer not only their course materials, but also their course structure for teaching onto the Web. Most course management systems support the uploading of digital objects of many types into courses and sometimes into shareable libraries from which course content can be selected. Typically these systems strive to recreate the structured organization we think about when considering the delivery of traditional course materials online, and they do this well.

Critical thinking and creative knowledge building requires flexibility and responsiveness that tends to differ by discipline and pedagogy. One approach that involves the graphical representation of ideas uses concept mapping to lay out ideas, processes, and their interconnection around a given problem area.

Concept Maps

Concept Maps are graphical representations of knowledge that are comprised of concepts and the relationships among them. Commercial software such as Inspiration or Microsoft's Visio provides integrated diagramming and outlining environments that can help students comprehend concepts and information. Freely available Concept Mapping software has been around for some time from the Institute for Human and Machine Cognition (http://cmap.ihmc.us/index.html). Concept Maps are often used in reference to some particular question for which we seek an answer, called a focus question. The Concept Map may pertain to some situation or event that we are trying to understand through the organization of relevant knowledge. A significant characteristic of Concept Maps is crosslinks, representing explicit relationships between or among concepts in different regions or domains within a Concept Map. In educational settings, Concept Maps are used to:

- Organize instructional materials for individual courses or entire curricula
- Serve as navigational aids for hypermedia
- Scaffold understanding
- Consolidate educational experiences
- Improve affective conditions for learning
- Aid or provide an alternative to traditional writing
- Teach critical thinking

When Concept Maps Become Content Maps

Tufts University has built a new tool, with support from the Andrew W. Mellon Foundation, called the Visual Understanding Environment (VUE, http://vue.tccs.tufts.edu/) for building Concept Maps. Using a highly flexible, visual interface, VUE maps, structures, and semantically connects electronic content drawn from local file systems, the Web, or FEDORA-based digital library systems. Unlike the concept mapping tools described above, VUE goes beyond creating flat representations of information and becomes an interactive interface to manipulating the data itself.

VUE is not a replacement for course management systems, but an application designed to address the activity of structuring and presenting digital materials and the ideas. The maps created with VUE become another resource within a course management system or digital repository, literally offering students and instructors an alternative view of a set of curricular materials. VUE leverages the open and extensible development platform of the Open Knowledge Initiative (OKI) and the FEDORA

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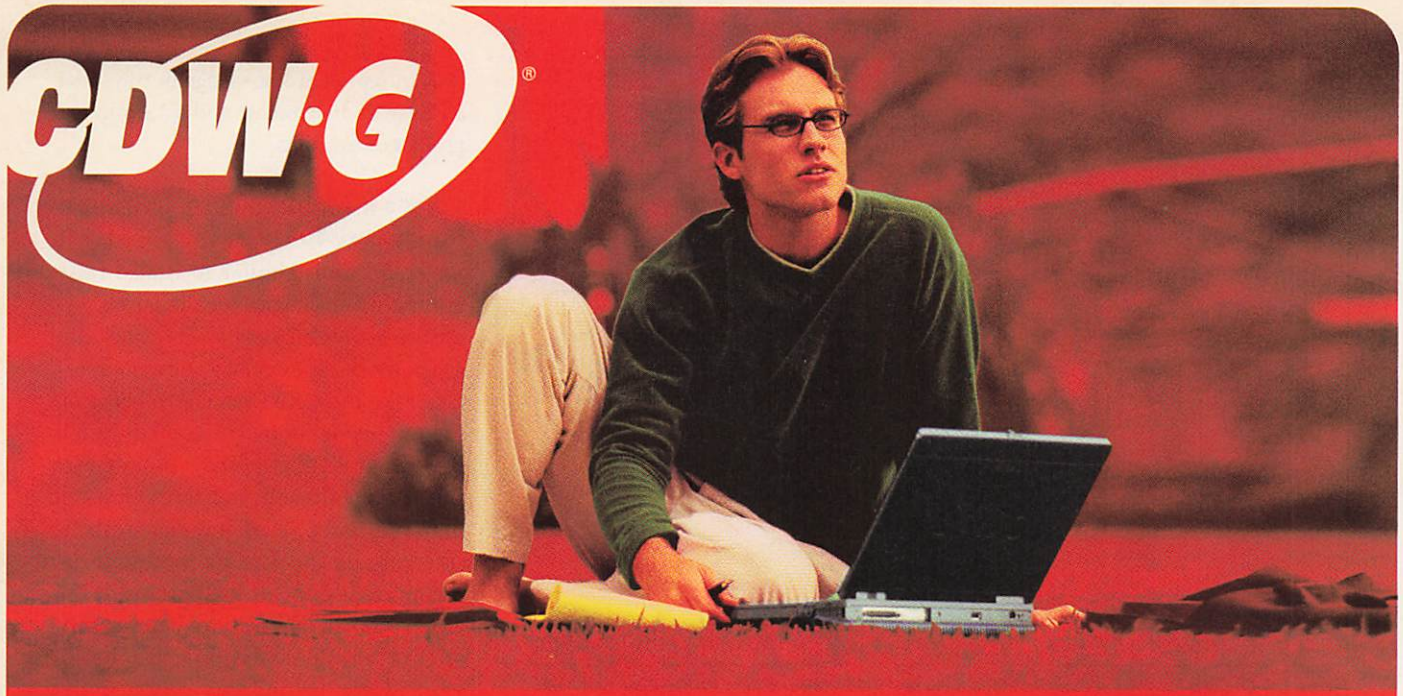

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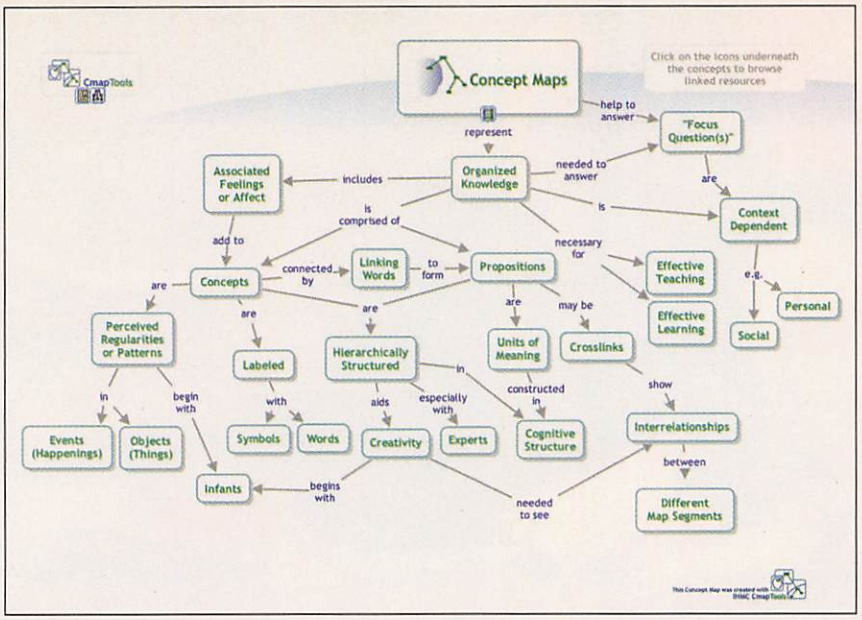

Figure 1. A Concept Map about Concept Maps, from the IHMC Web site (http://cmap.ihmc.us/), and created by the IHMC Cmap Tools

digital repository to develop a visual environment for structuring.

Concept Maps engage students as active participants in the structuring of information into knowledge and meaning. Through establishing personal connections among materials and/or by adding additional resources to an existing instructional concept map, students begin to relate new information to pre-existing knowledge. These concept maps can then be shared with instructors and peers for further review and discussion. The explicit act of organizing, annotating, and connecting educational resources via a concept map is a powerful educational exercise.

As valuable as Concept Maps have been, they are relatively static, representing interrelationships among ideas that, when created using typical software applications, can at best include URLs to link ideas to Web resources. When concept maps and the ideas they represent are connected to digital resources themselves—not just their links—concept maps also become *content maps.*

VUE extends the power derived from graphical representation of knowledge into a tool for mapping against and drawing from persistent collections of content contained within digital libraries. Using OKI's Digital Repository Open Source Interface Definition (OSID), among others, VUE allows users to search, browse, retrieve content from digital repositories, and upload resources into digital collections. The FEDORA digital repository was used in the initial implementation of VUE. However, VUE can be used along with other digital repositories such as DSpace, ArtSTOR, JSTOR, or any repository that implements and exposes an OKI interface.

VUE represents a first step toward bridging traditional boundaries among search tools, digital repositories, and applications for teaching. Faculty and students live in a fluid interconnected world where ideas, content that describes them, and their communication blend together as we gain understanding and meaning in complex patterns. Tools like VUE are promising indications that we might be getting closer to understanding how to represent knowledge in ways that are easy to disseminate and act on in the process of teaching.

What's a Digital Repository to Do?

VUE and tools similar to it also raise interesting challenges for digital repository owners or builders. VUE reaches into a repository exposed by a software interface (like the OKI DR OSID), bringing the bits representing the content into a new context. It's important to note that this is done directly, not through some import/export process. It is done without interrupting the user by forcing reauthentication—one of the benefits of the Open Knowledge Initiative approach. Access and permissions are being granted, but behind the scenes, so the user can focus on the task at hand.

Directly pulling content from digital repositories for other uses can raise issues about the integrity of the repository, collection management of the bits therein, and a host of intellectual property questions that often surround the deposition of content into collections in the first place. For many repositories, the separation between the raw content and its presentation raises fundamental questions about what is central about the repository itself. These are important questions and we need to address them now.

Phil Long, Ph.D. (longpd@mit.edu) is senior strategist for the Academic Computing Enterprise at MIT. He is also a senior associate for the TLT Group of the AAHE.

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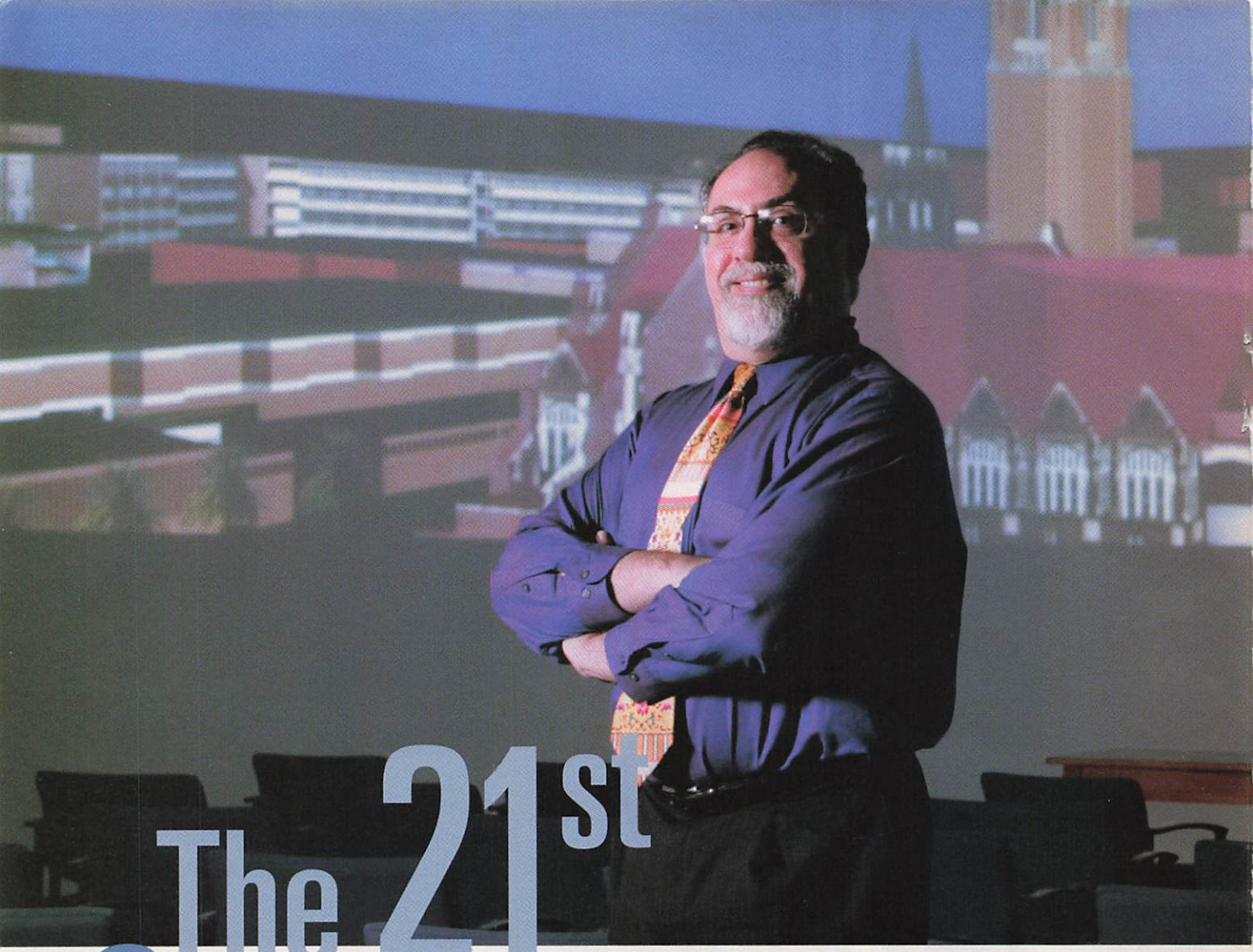
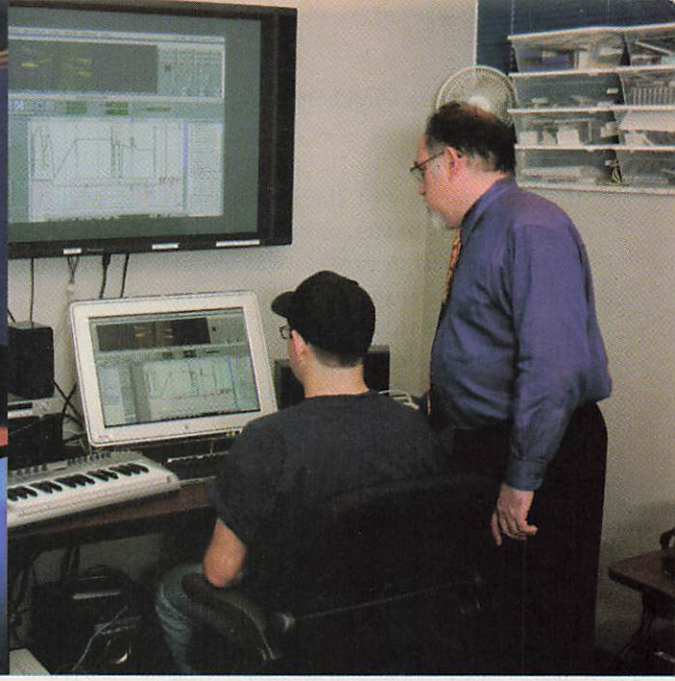


The 21st Century Chalkboard

DISTRIBUTED COLLABORATION IN HIGHER EDUCATION

An interview with
James Oliverio
Digital Worlds Institute,
University of Florida

Technologies for presentation and collaboration in the classroom are expanding the geographical boarders of the institution and helping to break cultural boundaries. Here, *Syllabus* speaks with James Oliverio, a professor and director of the Digital Worlds Institute at the University of Florida, about that institution's pioneering work in distributed collaboration.



Syllabus: In your work at the University of Florida, you've incorporated new media into a distributed collaboration model. What is the basis for the multi-faceted collaborative environment at the Digital Worlds Institute? What is your core operating principle for telecollaboration?

James Oliverio: Part of my background has been in the performing arts and in collaboration with people in a wide variety of projects across the arts and other fields. I've found that the basis of collaboration is what goes on *between* people, whether they're building a house with a hammer or trying to create a dance from around the world over a computer network. In an ideal situation, our technology would be so evolved that it would be totally transparent, allowing us to communicate using all the non-verbal, non-text cues that have evolved over thousands of years. So, the basic idea was not to hide students or instructors behind computers when they're allegedly interacting.

S: Allegedly?

JO: One of my pet peeves with education technology is that oftentimes, people just talk about the *boxes*—focusing on acquiring more computers with year-end budgets, or sometimes trying to teach classes in computer labs. To me that's not really the most effective way to collaborate, especially if you're going to be involved in a variety of projects. It's important to craft a space that is technologically sophisticated but people-friendly, and very comfortable to be in as well.

S: As an Emmy award winner, you have a distinguished background in theater and the performing arts. Do you relate telecollaboration to theater in some way?

JO: In theater, we have a stage that, in its raw state, is just a bare, open space. Within that stage we can create an incredible array of experiences that engage the audience and the actors as collaborators. Referring to the metaphor of performing arts as a model for creating virtual space, I often ask my students to name the earliest kind of virtual environments. They'll say, "The CAVE, 1980s, Chicago," or something like that; and I'll say, "How about the Greeks?" And they'll look at me and say, "But they hadn't even invented electricity!" Then I say, "Well, they made their own." And you know, theater is one of the most compelling types of virtual reality that we have.

S: Then how did you use this model at the Digital Worlds Institute? What is your stage?

JO: We had the opportunity to design a space from a 6,000-square-foot open area in an old gymnasium that we refurbished. Rather than use small rooms and try to pack them full of the latest high tech stuff, we made a large space that can be transformed, depending on the type of collaboration that we're trying to do. And whether it's fifty people in one room here, or ten people in this room and fifty more people on the other side of the planet, it's still

Photography by Preston Mack

James Oliverio in the REVE immersive theater (opposite page). Clockwise from top to bottom: UF dancers perform in virtual space; Sound design in the Digital Media suite; and Producer Joella Walz at the REVE control console.

the transparency of the interaction that leads to better collaboration. Again, the design process was about creating something from an empty space—rather than trying to use an existing room that you fill with technology and then squeeze people into that tight space.

S: What is the most important characteristic of this type of collaborative environment?

JO: Well again, the notion of flexibility. In this particular space we're able to hold traditional lecture-style classes. And, we can also host actual performing arts experiences. We can do large immersive virtual environment displays, ceremonies, receptions, and depending on how we configure the room we're able to bring together students and faculty from different cultures on one campus—that is to say, we have people from aerospace engineering collaborating with people from visual arts, which is not a common kind of thing, at least until recently.

We've been able to configure the space to suit people's needs, and if they need some telecommunications or video conference displayed with a large-format system, we're able to combine all of that technology; we layer it into a large-scale projection environment without the collaborators having to worry about the technology.

S: It sounds like providing technology staffing is a major part of this effort.

JO: Yes, a big part of it is to have a staff or some people who are trained in operating the system. And we do look at the facility itself as one system, rather than a structure that has some systems stuffed into its walls.

S: How is it that people from different disciplines are working together on these collaborative projects? Is that one of your goals? Are you promoting cross-disciplinary projects?

JO: I think that at universities people are often categorized and characterized by what their job role is in a certain department. These designations have a lot of connotations, both positive and pejorative, depending on which culture is looking at the other. Yet we can find ways to bring people together for a common project or a goal, take them out of their cubicles, and let them concentrate on the parameters of a project in order to see what the other one is doing in a shared space.

The Digital Worlds Institute (DW) at the University of Florida

The focus of the DW institute's mission is on education and research in digital media. DW combines expertise from the arts, sciences, humanities, and engineering in order to help solve real-world problems in a digital world environment. "Digital Worlds" are computer-based systems capable of representing various aspects of real-world objects and environments through the effective application and integration of polymodal information rendered in digital media formats.

www.digitalworlds.ufl.edu/

S: Do you see collaboration technologies that work well across disciplines maybe even spawning new disciplines?

JO: Absolutely. And I think this is one of the things that's going to be happening more and more if we're successful in higher education in going through the cell membranes, so to speak, that keep traditional fields apart. This will include, I think, combinations in the humanities, the liberal arts, and the sciences. It will work if we're able to have contemporary professors not so much worried or afraid of or even concerned with the technology; if they can use it somewhat like they would use a pencil or a pen. One of my goals here is to make these tools available in such a way that people feel comfortable using them, just as they would using a writing implement. One of the latest technologies we're working on now basically does that. It uses an off-the-shelf laser pointer. Anyone can have it in the class, and activate or interact with material on our 52-foot screen without having to touch a computer keyboard or a mouse.

S: So is it your objective to make it easy to include everyone's work in a shared display?

JO: To me, when everyone can see the big picture and indeed share in creating it, that's a different kind of screen experience than poking on your little PDA, which is actually an alienating kind of situation for personalized collaboration. I tend to say that what we've created here at the REVE, the Research, Education, and Visualization Environment is a 21st century chalkboard, and everybody gets to write on that chalkboard—not just the people that can draw really nicely or only the people that can write the best equations. Everybody can take the chalk, so to speak, and put up their own marks, and everybody's work stays up there at one time, so everyone can see the big picture.

S: Do you look at all this interdisciplinary collaboration as something that could be very strategic—even leading to some restructuring of the institution?

JO: At least from the direction we're coming from it's not. We're not thinking strategically in terms of reorganizing an institution, but rather realigning personalized relationships. I look at teaching and learning as really central to the mission of using these technologies, and that depending on what the content is, if we're teaching and learning biochemistry or digital media, and we're teaching and learning how to collaborate, those are skills that are not generally taught in traditional institutions.

Part of my goal with all this work is to get back to what I consider a

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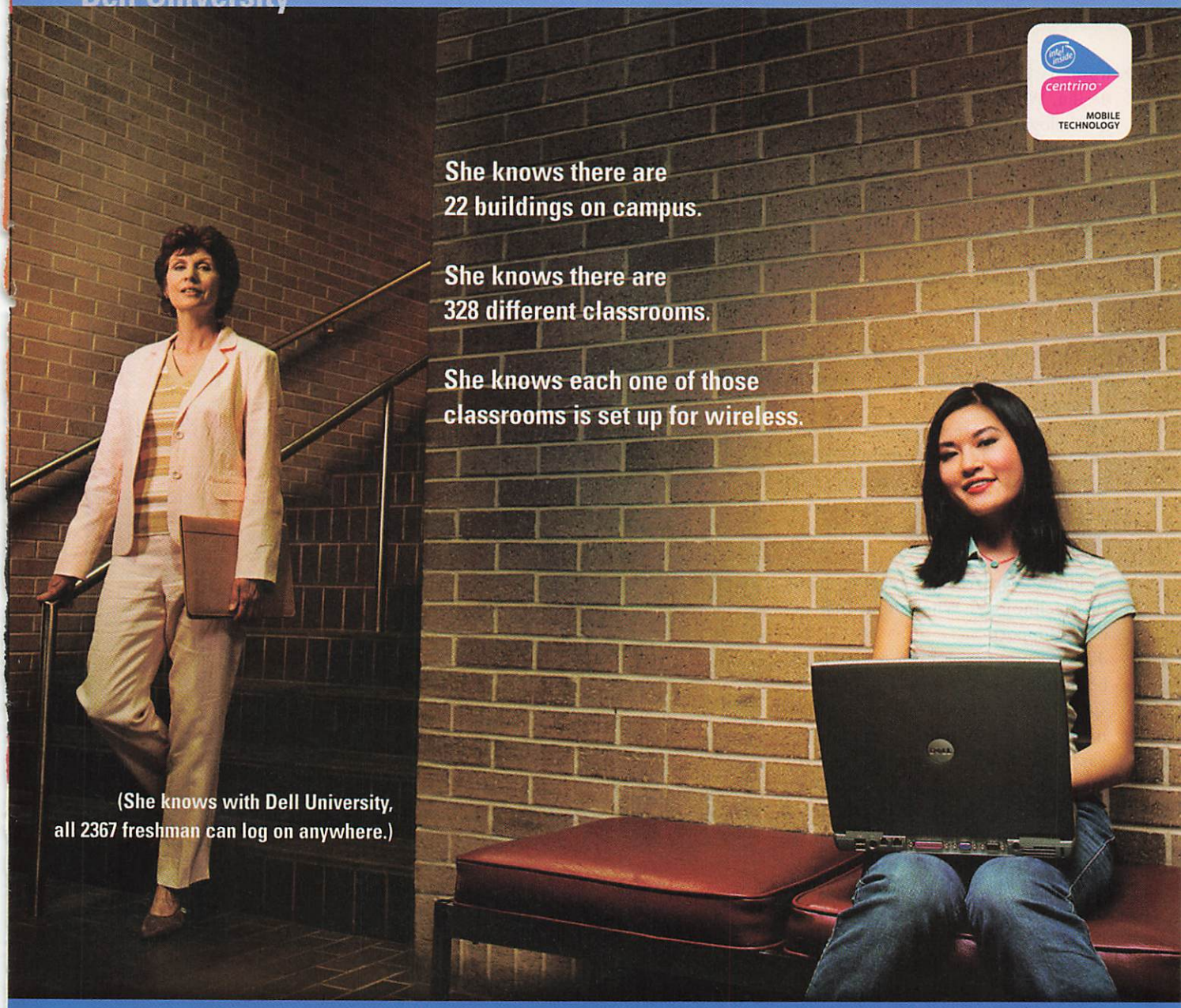
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human-scale and a human-centered design. When we make these boxes or technologies accomplish a certain kind of function—be it to allow communication across a distance or collaboration between departments—the more that people can interact in their own way rather than to change their behavior to accommodate the technology, the better.

S: So you're really developing technology that supports more human-centered interactions...

JO: If we can create spaces that are enhanced by digital media and more naturalistic interfaces, I believe that we're going to spend more time collaborating, learning, retaining, and creating.

S: How do instructors react to using this technology? What about instructional support?

JO: We cannot expect our professors to be technologists if they're going to be specialists in other areas. We've got to make this collaboration technology as easy for them to use as a copy machine, a telephone, or a pencil. A lot of times, you can show instructors a given technology, but they're either loathe to use it or they're afraid or confused, and they just would rather do it the way they've always been doing it. This is bad on both sides of the equation—for the learner in today's world, it's bad, but it's especially unfortunate if it's alienated the content specialists or the professors.

S: Can you talk specifically about the REVE for a little bit? How did that evolve, and what have you been able to do with it?

JO: Sure. When I first came to the University of Florida in 2001 I was invited to be on the High Performance Computing committee, or HPC, and this was literally a lot of physicists and rocket scientists and network engineers that were trying to figure out how to use emerging, advanced systems over distances for collaboration in science experiments. They were using a communications tool called the Access Grid. Grid computing, as you probably know, is hooking a lot of different computers together, oftentimes at a distance, and letting them crunch the numbers to combine their resources instead of trying to use one computer in one location. The Access Grid was established to try to do the same, to bring people together into a shared space over a distance—not just point-to-point, but allowing many people see and talk to each other in the same shared space. When I saw that technology, I thought it would really be great if we could get performing artists and people from theater, dance, and music to use this tool to collaborate across boundaries. So we demonstrated that in a project that was literally called *Dancing Beyond Boundaries* at the Global Supercomputing Conference in 2001.

S: I've heard that was the hit of the show...

JO: We were the only group of artists there, and the scientists were fascinated by how these, quote, "art people" were doing something with their technology that none of them had ever imagined. There was a master percussionist performing in Brazil, and dancers in Minneapolis, and other musicians in Florida, and dancers in Denver—all collaborating to create a new piece in

The REVE: Research, Education, and Visualization Environment

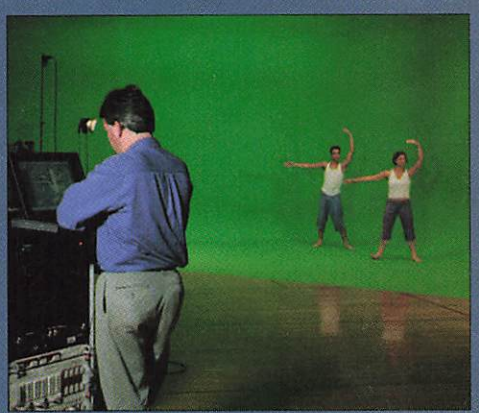
A flexible space at the Digital Worlds Institute for research and education, including a digital media environment with facility for distributed collaboration and video conferencing. The space includes the following rooms:

- Polymodal Immersive Theater (PIT): Provides large-scale immersive visualization capabilities for an audience of up to 48 people

- Virtual Production Studio (VPS): A large open studio with green screen, video projection, Ethernet access to Internet2 and Access Grid potential

- Digital Media Suite (DMS): A variety of production and post-production systems, ranging from digital video editing and compositing to audio and animation tools

- REVE Image Generator (RIG): An integrated computing and image processing system designed with both a graphics supercomputer and PC cluster connected to the high-speed network



Supporting technologies include immersive video display systems (both mono and active stereo projection), mobile Access Grid and VBrick carts connected over Internet2, image generators including SGI graphics supercomputer and Dell cluster, visualization tools including SEOS Chameleon with Scorpion Real-Time compositing system and MultiGen-Paradigm VEGA. Theater environment includes Digidesign ProTools running in 5.1 surround sound and the Digital Media suite provides a host of production tools.

http://www.digitalworlds.ufl.edu/facilities/REVE/default.htm

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three days. And they'd never met each other. They were in two different continents and four different cities.

S: And the REVE took off after that...
JO: Yes, *Dancing Beyond Boundaries* was the beginning of our distributed collaboration. Since that point we've built the REVE and done some other projects that have expanded to three different continents in real time. Because we've got a flexible space here, we're not only able to house the participants in the collaboration, but we're also able to include audiences. And because we're involved in education as well as art and science, we've worked on a lot of techniques, including camera placement and space configuration.

S: You've worked on another project more recently called *Non Divisi*. How is that different from *Dancing Beyond Boundaries*?
JO: The difference is that *Dancing Beyond Boundaries* was done from the show floor of a huge convention center and a couple other smaller studios. With *Non Divisi*, we've been able to center the operations here in two spaces within our new building and then project outwards from Florida to Korea and South America.

S: Is that something you plan to continue to do going forward, these global collaborations?
JO: Yes. We actually have a team of people in various cities around the world now, and we've been asked to do some things for a big festival in Italy that will be coming up in the fall. In addition to that, we're planning on working more with engineers and artists to create shared virtual environments so that not only will the experience be realistic—as in looking at video—but the live performers will be able to inhabit shared, highly visual spaces that have been created by animators.

S: How might you use the Access Grid in the future? And how might you gauge your progress?

JO: Grid Computing first came out of the notion of using distributed computers to help solve problems. Then, the Access Grid made it more collaborative by actually layering video with live people distributed to work on solving problems. Initially, scientists and researchers at organizations like Argonne National Labs would just talk to each other and give presentations remotely. But video being a very malleable medium and certainly one that's accessible to people intuitively, we felt that it can be used in a lot of ways that the system may not have originally been designed for. I view communication as a one- or two-way street where when I say hello, and you say hello—

REVE Technologies

DISPLAY SYSTEMS

SEOS Chameleon with ScorpionRT
www.SEOS.com

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projectiondesign F1 SXGA
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Pioneer PDP-502 plasma screen
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we've just communicated. But if we're going to collaborate, that's a higher level of interaction than a simple communication.

Now, to create things in the arts, even if everyone is in the same room or on the same stage, there is a relatively high level of collaboration. Systems engineers attempting to analyze what we do in our distributed collaborations would have lots of words and processes that they could talk about. Whereas at the REVE, we're doing collaboration at this point fairly intuitively, rather than strategically from a structural analysis. But we do believe that's in part why it seems to be working so well—because we're just acting like people, as opposed to analysts, at this point.

S: Can you envision what might happen with the technology for telecollaboration in the future, say in five or ten years?

JO: I think we're going to get closer to what we consider realism, in other words, the fidelity of the signal will get better; the video will look better. Better audio and more immersion—immersion meaning either that you're totally surrounded by the technology or just engrossed in it because you're not thinking about anything else. There are two schools: One creates immersion by physically putting the projectors all around you or by having you wear a head-mounted display. The other, which I think is potentially more compelling, is to have the experience so engaging that you're not thinking about anything else even if it's on a small screen.

S: What are some of the major changes we'll see in practice, regardless of which of these two schools of thought you follow?

JO: When we talk about where this collaborative technology would lead, I believe it follows from one of the key things that it has enabled so far. It will continue to give us a sense of cultural perspectives from people around the world that we would not have had otherwise, regardless of how many books or Web sites we've read. I feel that one of the best things that could happen with these collaborative technologies is that people of all ages would have a lot more contact with others from around the world, and understand other cultures better. Then in the future we wouldn't have to send tanks to make up for the shortcomings of those who had come before.

S: What infrastructure or planning has to be in place for all this to happen? Is there any organization that can influence this the most?

JO: The infrastructure piece that we need to have is more bandwidth going to various communities. We shouldn't concentrate so much on more expensive boxes at the end of the link, but just work on getting the link there. And I believe in having spaces not unlike the REVE that are not incredibly expensive to build and maintain but have good connectivity and provide a conducive atmosphere for people to come together—whether physically in the same space from different disciplines, or from across the planet from different cultures—to find what their common denominator or their common shared experience is.

In this country Internet2 has obviously been a major player. I think that we need to find a way that every institution, from the community colleges on up to the senior institutions, are hooked up, to if not Internet2 to another peer network, and make that a basic commodity—rather than a luxury only for the research universities.

I think that the solution from a technological and economic perspective is not simply to throw more boxes into the schools, but to spend more time connecting all the schools to a common network or a common access point so that they can share their resources, and that will help across disciplines, across institutions, and I believe ultimately across cultures.

S: So do you think that many other institutions could offer similar programs soon?

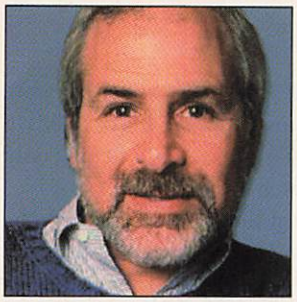
JO: Now, I don't think of any of this as a pipe dream.

I wish I could say it were inevitable. I think it's possible but again, a big part of what we need to do is to distribute access to the resources rather than to try to populate rooms with boxes and put students behind the boxes. Our screen and our 21st Century chalkboard needs to be larger and easier to use.

I believe that we could implement a lot of these at other institutions for a relatively modest cost and then develop content to be shared and techniques for people sharing live courses. None of this technology is terribly new by itself, but the integration of all these pieces does not seem to be common yet. Eventually, we will develop ways that we can have our partners in various institutions around this country and beyond begin to use these tools so that they become taken for granted. I believe we can do this within two to five years. I don't see why any higher education institution, if it is willing and interested, couldn't have spaces like this to use on a daily basis.

I don't see why any higher education institution, if it is willing and interested, couldn't have spaces like this to use on a daily basis.

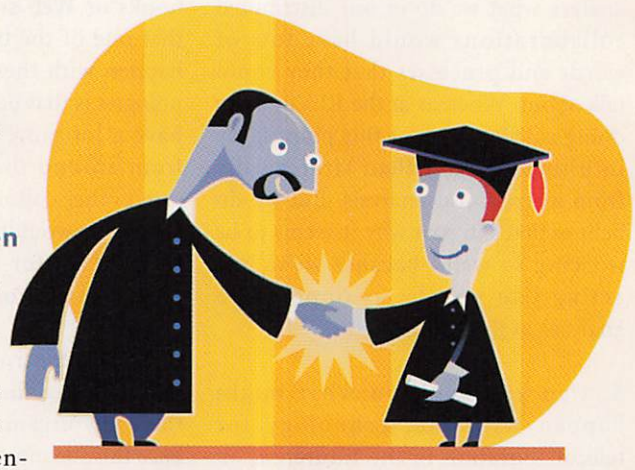
*[**Editor's note:** James Oliverio's Web presentation about his work at the Digital Worlds Institute, recorded with MediaSite Live, can be viewed at: http://www.syllabus.com/collaboration/]*



Kenneth C. Green

DIGITAL TWEED

Commencement 2004



Springtime in Academe. This is the time when commencement speakers across the land regale, bore, entertain, and attempt to challenge the Class of 2004.

This year's commencement speakers will echo the themes articulated by the ghosts of commencement speakers past: this era will be the best of times, the most challenging of times. No question these will be interesting times. (FYI: contrary to conventional wisdom, a quick Google search suggests that this is *not* an ancient Chinese greeting/curse.)

For the graduates who began their college careers in the late 1990s, the world they "enter" with their new college degrees is very different from the one they knew as college freshmen. They (and we) live in a world and an economy that is post Y2K, post-dot.com, post-9-11, and (hopefully) emerging from recession.

The good news for this year's graduates is that the job market may be improving. Early indicators suggest that employment opportunities should be much better this year than in recent years. The welcome employment upturn notwithstanding, job options for (and salaries of) new college graduates will be well below the levels posted in the closing years of the Clinton/dot.com era.

On the technology front, there should be no debate that computers have become less inexpensive: over the past four-to-five years Moore's law assures that laptops and desktops continue to "do more for less." Cell phones have become ubiquitous; wireless networks and services—on and off-campus—are becoming so.

Step back a bit and we see that the whole concept and connation of *wired* has shifted significantly in recent years. Recall, for example, the annual "Wired Campus" report from (the now departed) *Yahoo! Internet Life Magazine*. It was an unpopular (unpopular among campus officials!) effort to rank U.S. colleges and universities on their technology services and resources. Today the notion of "wired"—access to/using lots of technology—increasingly points to "wireless" students who wander campus with their cell phones, PDAs, and notebook computers.

Also on the IT front: over the past four years, through the rise and demise of the dots, the Web continues to touch more of what we do and how we do it, on and off campus. To paraphrase the 1972 observation of George Bonham, founding director of *Change* magazine, technology and the Web today, like television in the late 1960s and early 1970s, "dominates much of American life and manners."

As in past years, some of this year's grads will stay on, migrating from *alma mater* in the spring to grad school in the fall. Over the course of their undergraduate years they were touched—carefully, appropriately, magically, and metaphorically—by faculty (by some of us!) in the arts and sciences. We became their mentors, suggesting and then fostering an interest in a faculty career and life in academe.

The distance from baccalaureate graduation to graduate school is one of time, place, and space. It also represents a leap of faith. The students who go on to law, medical, and business school do so with reasonable confidence about the careers that follow: retention rates are high and career paths are fairly direct.

In contrast, and regardless of

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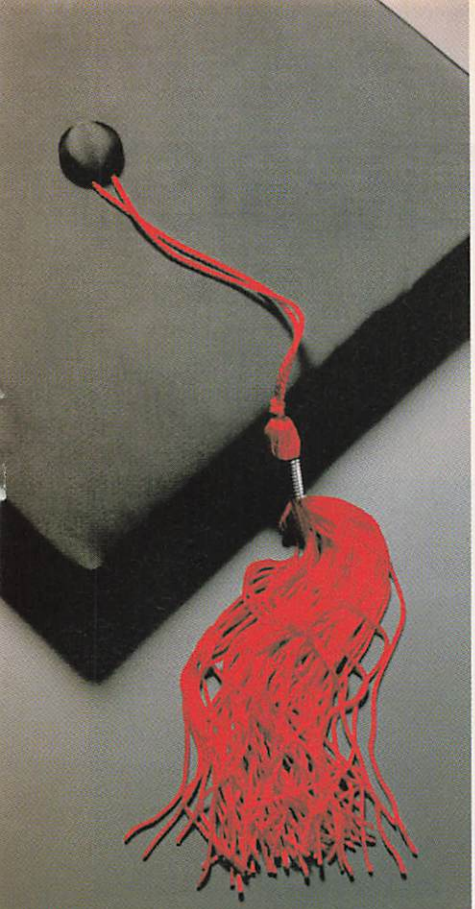
MITSUBISHI PRESENTATIONS



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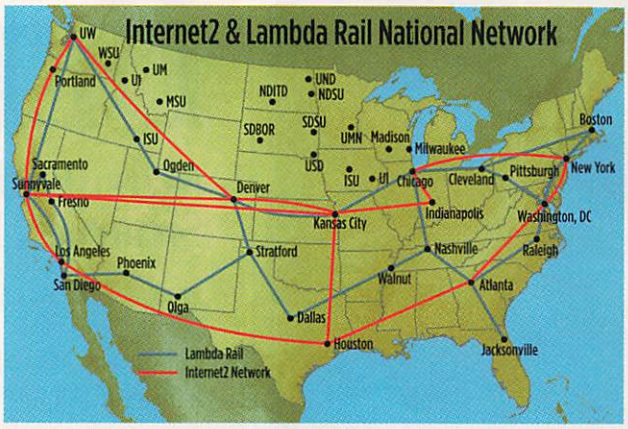
More About Networks: A Regional Perspective

Network users are becoming more connected to resources beyond the walls of the institution. Can you go that "last mile"?



I have just returned home from the spring Internet2 meeting, a gathering of IT folks and the occasional faculty member from across the nation and around the world. This is a meeting with a focus on research and education networking nationally and internationally. It is a gathering where the focus is on taking advantage of the capabilities of the Internet2 backbone network (a network that is often called Abilene). The backbone for this network runs across the country from New York and Washington to Los Angeles and Seattle. It also goes south through Atlanta and Houston. Universities and coalitions of universities then build on ramps to Internet2. And thus we connect to our colleagues in other universities around the country.

Internet2 provides access to global networks that take our researchers around the world. Today, a new high-speed research network is evolving in the United States. It is known as National Lambda Rail (NLR). NLR is being designed not only to move massive amounts of research data around the nation, but also to allow researchers to do research on the network. It will be used for production network purposes for researchers and to do research about networks. The map of the U.S. shows the Internet2 network route and the proposed (and evolving) route for NLR. But at the campus level, this national research network infrastructure is only as good as our connections to it. And look at the map again. You can see, we have a "last mile" problem, or for my friends in the Dakotas, it's a last *hundreds of miles* problem. As we look at exciting applications that some folks are running across Internet2, it is clear to many of us that we can't do what those in Pittsburgh and Denver, those on the main line, can do.

In Madison, it would not be wise to try to orchestrate a dance class with the students in Madison and the choreographer in Corvallis. Sure, we can do video over IP, but there is no guarantee of decent end-to-end performance. The faculty member could get lost on the network, or have his head and his body in different universes on the screen. No matter how well the students in Madison are performing, the faculty member could be viewing dancers who are not moving in time to the music and whose movements are extraordinarily choppy. The idea of a master class using the network is fine. The successful implementation depends on the location of the two end points.

And that's simply one example of the challenge. At our state network Future Technologies Forum, we had a great speaker, John Delaney from the University of Washington. John is the program director of Neptune, a project to build an undersea observatory off the West coast between Portland, Oregon, and Victoria, BC, that allows observation of interactions between living and nonliving elements under the sea. The intent of Neptune is to make the information and the experience of undersea exploration available not only to scientists, but also to students, from kindergarten to graduate programs. The capabilities for simulating undersea environments and ocean exploration that Neptune will offer are boundless. For our students and teachers in Wisconsin to take advantage of this phenomenal opportunity, we need to be better connected throughout our state, to the national research network infrastructure.

In Wisconsin, we have banded together with our colleagues in Minnesota, Iowa, North Dakota, South Dakota, Montana, and Idaho in an attempt to build another line on the

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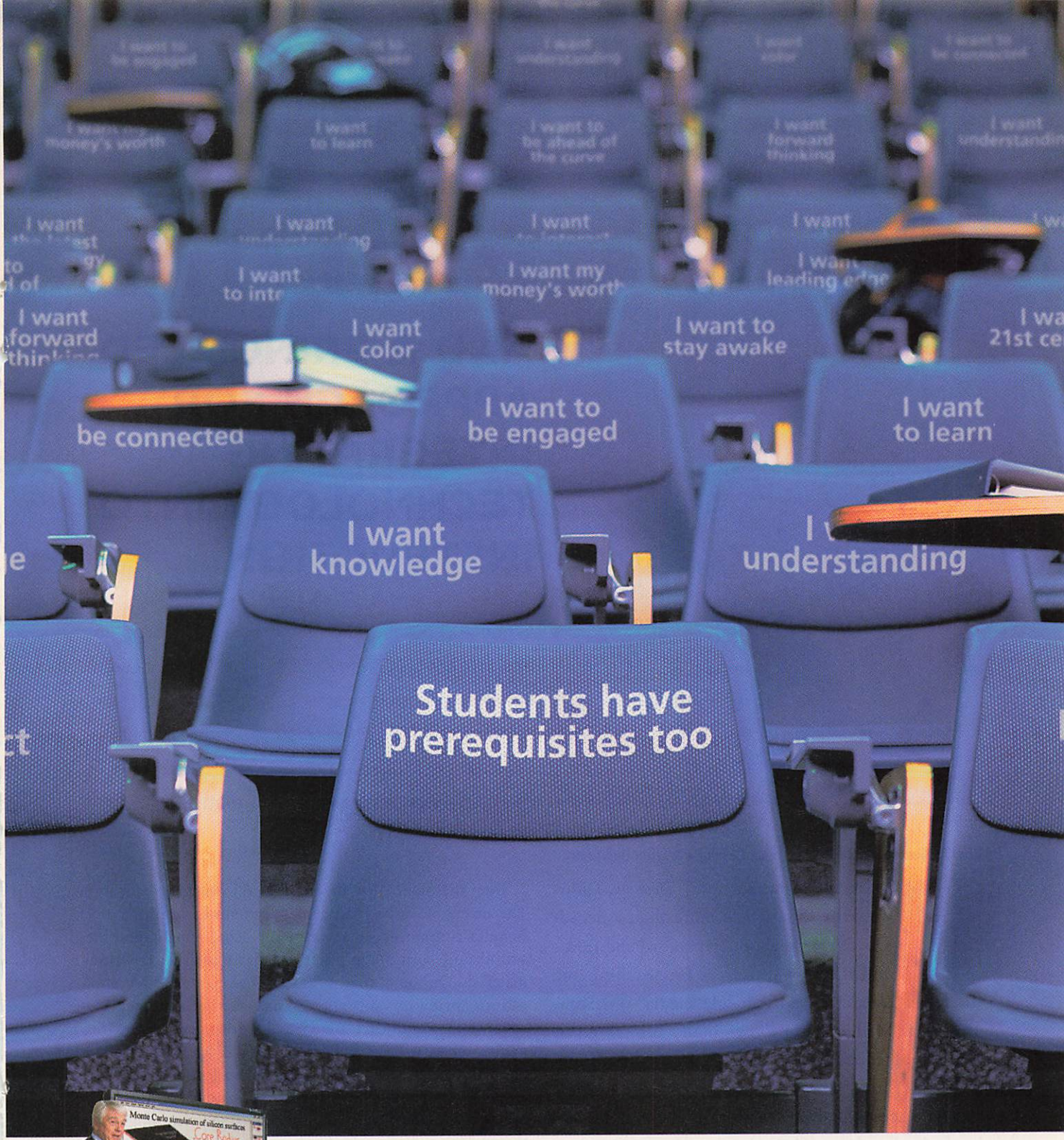
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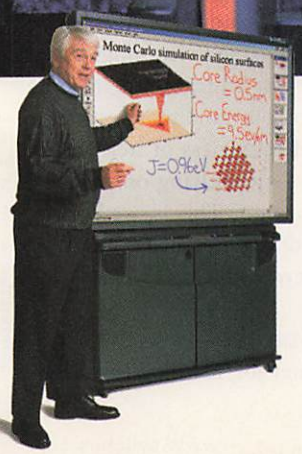

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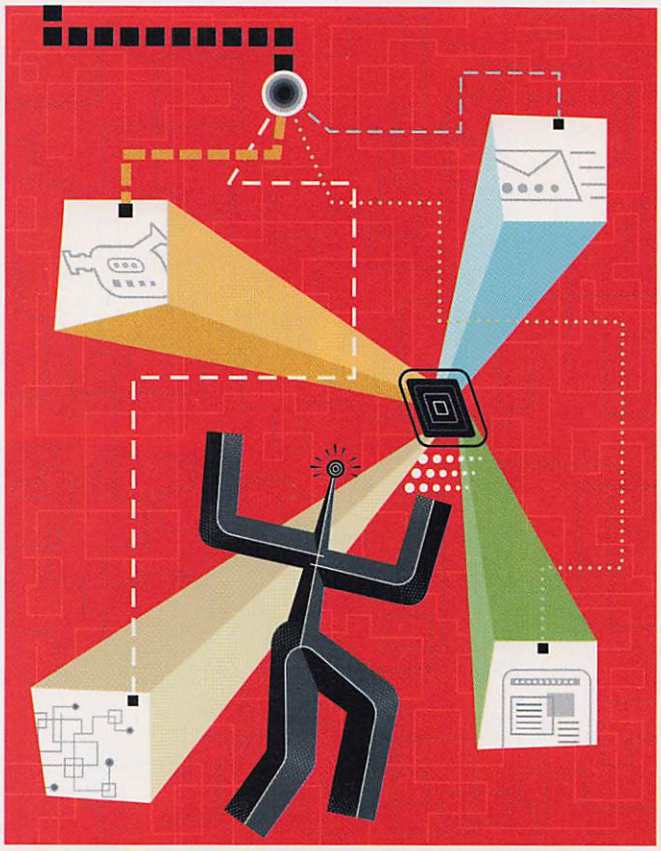
THE "NEWEST MEDIA"



AND A PRINCIPLED APPROACH FOR INTEGRATING TECHNOLOGY INTO INSTRUCTION

When and how should new media be incorporated into instruction? Two leaders in instructional technology and cognitive science from Carnegie Mellon University offer concrete suggestions from their experience, illustrated by applications of new media by the Open Learning Initiative at CMU.

By Joel M. Smith and Susan Ambrose, Carnegie Mellon University

"New media in instruction?" *Déjà vu.* Didn't we write that article more than a decade ago? Wasn't it about HyperCard and JPEGs and Internet resources for teaching and learning? Isn't that "old media" yet? Some of the "New Media Centers" originally sponsored by Apple Computer are still here, but now they are populated with "iLife." The "new" in new media is ever-changing. There will always be novel opportunities and technologies, but there will also be not-so-novel questions about the integration of new media in education. As Clark and Mayer (2003) remind us, "What we have learned from all the media comparison research is that it's not the medium, but rather the instructional methods that cause learning." This is a reflection on the enduring question of the relationship between the "newest media" and instructional methods.

Even the older "new media" are still changing education. The advent of course management systems has meant a much broader community of faculty now using images, graphics, sound, video, and computer simulations as instructional materials. On top of that, newer technologies and their applications spring up constantly. What are the "new media" of 2004? Some candidates are: virtual worlds, gaming environments, blogs, wikis, intelligent agents, iPods, MP3 files and players, institutional repositories, and so forth. Technologies and adopters change, but the questions endure. Can these information technologies, in fact, add value to learning? Given the evolution of new media, how can educators determine what to use, when, and why? Hence, our guiding question is, how *should* educators assess the effectiveness of new media using performance-based measures—not relying only on the often-used survey of student satisfaction? This is, we believe, the question that has largely eluded a comprehensive answer throughout the recent history of "new media."

Informing Instructional Design

At Carnegie Mellon, the Eberly Center for Teaching Excellence

Illustration by Campbell Laird

and the Office of Technology for Education have forged a close relationship to consult with faculty colleagues on effective teaching approaches based in learning theory, including the integration of technology into course design and classroom pedagogy. One strategy we employ applies equally to any new approach in teaching, whether it employs "new media" or not. That strategy is to apply some of the best current knowledge from cognitive and learning sciences to assess proposed teaching innovation.

We ask our colleagues to think in a systematic way about any new pedagogical strategy, including the use of media. Couched in terms of use of "new media," some of the fundamental questions we pose include:

(1) What is the educational *need, problem, or gap* for which use of new media might potentially enhance learning?

(2) Would the application of new media *assess students' prior knowledge* and either provide the instructor with relevant information about students' knowledge and skill level or provide help to students in acquiring the necessary prerequiste knowledge and skills if their prior knowledge is weak? (Clement 1982, Minstrell 2000)

(3) Would the use of new media *enhance students' organization* of information given that organization determines retrieval and flexible use? (DiSessa 1982, Holyoak 1984)

(4) Would the use of new media actively *engage students in purposeful practice* that promotes deeper learning so that students focus on underlying principles, theories, models, and processes, and not the superficial features of problems? (Craik and Lockhart 1972, NRC 1991, Ericsson 1990)

(5) Would the application of new media provide *frequent, timely, and constructive feedback*, given that learning requires accurate information on one's misconceptions, misunderstandings, and weaknesses? (Black and William 1998, Thorndike 1931)

(6) Would the application of new media help learners develop the proficiency they need to *acquire the skills of selective monitoring, evaluating, and adjusting their learning strategies* (some call these "metacognitive skills"), because these skills enhance learning and, without them, students will not continue to learn once they leave college? (Matlin 1989, Nelson 1992)

(7) Would the use of new media *adjust to students' individual differences* given that students are increasingly diverse in their educational backgrounds and preferred methods of learning? (NRC 2000, Galotti 1999)

Each of these questions carries as its underlying presupposition a result from cognitive science. Collectively, we might call them "cognitive desiderata" for new teaching strategies. We have provided in associated endnotes reference to the research that justifies that presupposition for some of the questions. To give an example, question 2 is based on the principle that prior knowledge as the basis for building new knowledge can facilitate, interfere with, or distort the integration of incoming information. In other words, prior knowledge is the lens through which we view all new knowledge, so understanding [and then addressing] students' misperceptions when they enter a course will aid learning. This principle is justified by many researchers, including the work of J.J. Clement and J. Minstrell, which is referenced in the footnote on that question above.

We ask our colleagues to think in a systematic way about any new pedagogical strategy...

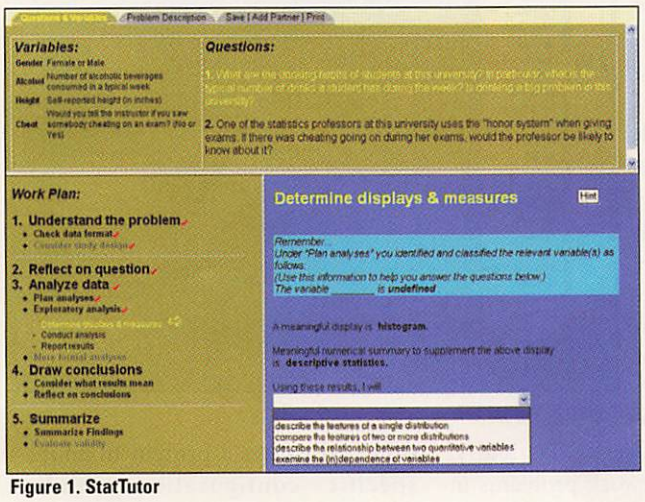


Figure 1. StatTutor

However "technocool" or visually attractive or absorbing a piece or collection of new media is, unless its instructional application plausibly justifies an answer of "yes" to the questions above, *prima facie* it is unlikely to affect educational outcomes. In contrast, if a proposed use warrants an answer of "yes" to one or more of the questions above, it stands a chance of making a difference. Of course, the ultimate test of whether any application of new media is instructionally significant is determined by empirical evaluation of its impact, an area that has too long been ignored in higher education in general.

New Media in Practice

Carnegie Mellon is currently undertaking a major project to develop Web-based courses and course materials that make use of some kinds of new media and are based on what we know about learning from the cogni-

tive and learning sciences. This project is known as the Open Learning Initiative (OLI) [http://www.cmu.edu/oli]. Faculty colleagues have brought to this project applications of new media that plausibly meet the "cognitive desiderata."

StatTutor

Consider one piece of the OLI, the StatTutor developed by Dr. Marsha Lovett, a cognitive psychologist, in collaboration with the Statistics Department at Carnegie Mellon. This is a Web-based tool for providing statistics students a scaffolded environment for learning how to represent, structure, and solve problems in introductory statistics. The creation of this instructional environment was a response to the concern of statistics educators that students often leave courses without the desired statistical reasoning skills and transfer ability, rendering their learning limited in use (Lovett, 2001). This establishes "need" per our first question. StatTutor also has strong affirmative answers to questions 3, 4, 5, and 6. The StatTutor environment appears in Figure 1 (page 23).

In the left-hand panel, the StatTutor provides the student with a "Work Plan," a consistent way for organizing analysis of the problem. The students click on each step as they address the problem. This approach provides "purposeful practice" that focuses on the problem-solving process inherent in statistical reasoning (question 4). This "scaffolding" is removed as students move through the course so that they internalize this way of organizing an approach to problem-solving (question 3).

Students are challenged to respond to a large number of questions about the problems in the right-hand panel as they step through the process. This interactive feature is tied to a version of a "cognitive tutor" (Anderson et al., 1995), which provides them with both feedback on incorrect answers and hints (note the Hint button) when they are stuck. Therefore StatTutor satisfies the criterion of providing "frequent, timely, and constructive feedback" (question 5).

Taken together, the deeper learning of processes involved in statistical reasoning and the feedback provides students with metacognitive skills (question 6) that will be applicable in multiple contexts for multiple problems.

The enduring questions provide us with a powerful framework...

Virtual Lab

Another course under development for the Open Learning Initiative is in introductory chemistry. One fully developed tool for this course is Virtual Lab, the work of Dr. David Yaron, appearing in Figure 2.

Professor Yaron has created this powerful open-ended virtual lab environment (certainly something qualifying as "new media"), not as a replacement for wet labs (although it might serve that purpose for populations that don't have any access to wet labs). Rather, his goal is to change the nature of how students think about solving problems in chemistry.

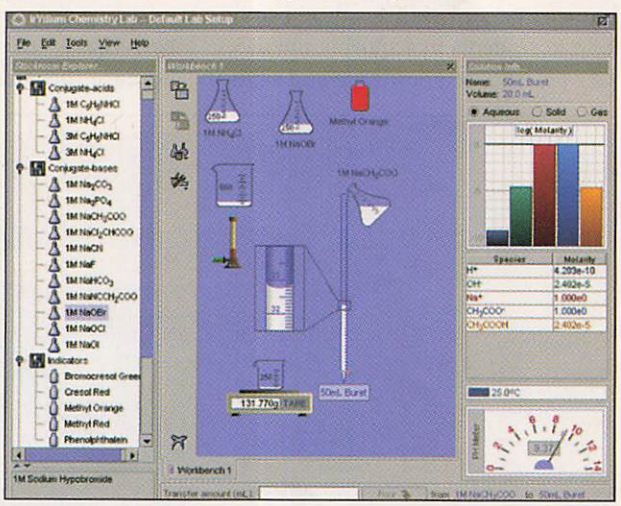
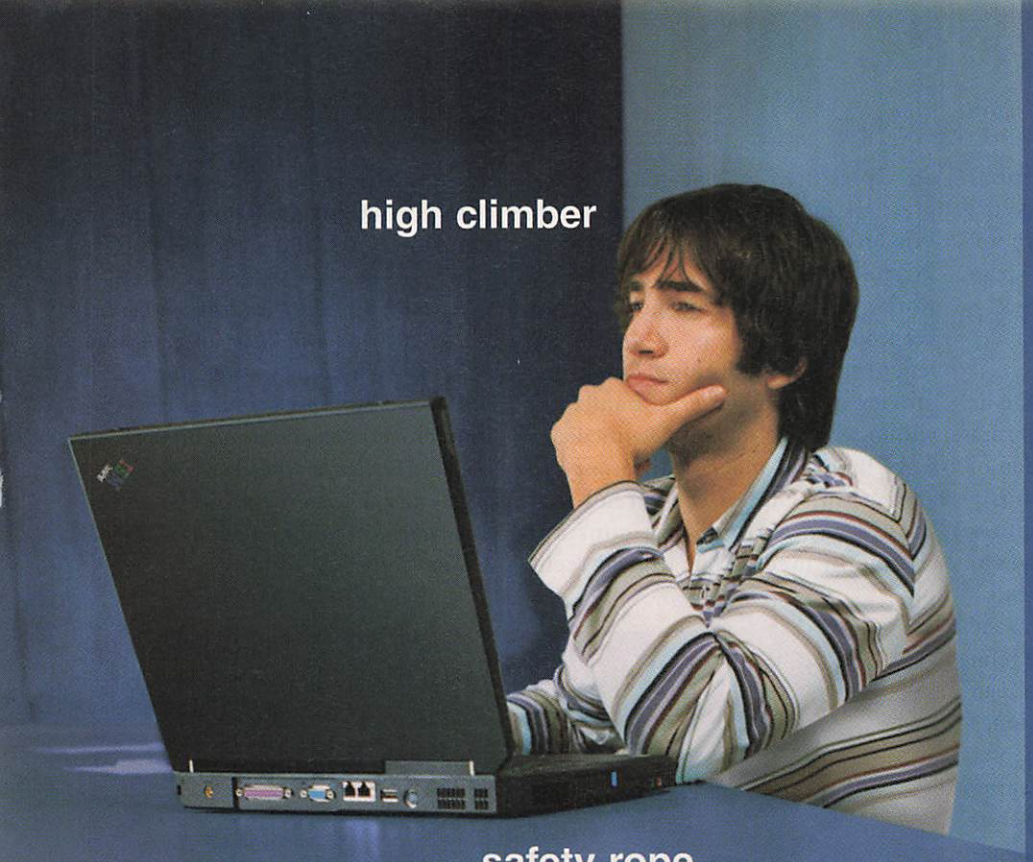


Figure 2. Virtual Lab

To the first question of our desiderata—"What is the educational need, problem, or gap for which use of new media might potentially enhance learning?"—he answers: "Typically, students solve homework problems in chemistry by thumbing back through the chapter to find the appropriate equations into which they can "plug in" the numbers given in the problem, and this is a poor way to learn how chemists solve problems." By using the Virtual Lab, he can change the nature of the problems presented to students. Rather than problems of the form: "An N molar solution of X and an M molar solution of Y are mixed together. What is the pH of the resulting buffer solution?" the problems can be formulated as "Go to the virtual lab and create a buffer solution with a desired pH." We believe this type of activity "promotes deeper learning," thus yielding an affirmative answer to question 4 and, when the questions are structured properly, lets different students solve problems in different ways (question 7).

Virtual Lab activities were the primary mode of practice, with course concepts and material for three out of the four instructional units (thermodynamics, equilibrium, and acid-based chemistry) this past semester at Carnegie Mellon. The Virtual Lab activities engaged students in new modes of interaction, such as experimental design and comparison of different chemical models, and used realistic contexts, such as acid mine draining and design of a chemical solution that causes a protein to adopt a specific configuration. Student performance on end-of-unit exams containing traditional assessment items was equivalent to or better in than past years when the virtual lab was not used. While feedback is not currently



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part of this experience, our questions point us toward the need for it and the Open Learning Initiative is adding mini cognitive tutors to the Virtual Lab so that students can get timely feedback.

Enduring Goals

We recognize that satisfying some or even all of the cognitive desiderata doesn't guarantee that an application of new media will succeed. Obviously recent research in human-computer interaction provides vital information to those creating eLearning environments.

The remaining piece, however, in the application of any new media is careful evaluation of actual impact. The Open Learning Initiative, following the long-standing practices of the Eberly Center at Carnegie Mellon and the Learning Research and Development Center at the University of Pittsburgh (an evaluation partner in the OLI), engages in various kinds of evaluation of the impact of new media in its courses. Some techniques are based on a unique feature of digital learning environments: their capacity to record every choice a student takes in problem-solving. OLI courses and media tools are being instrumented to record student performance, both in learning environments like StatTutor and the Virtual Lab and in associated online assessments. The result is a test bed for experimenting with different kinds of educational uses of new media. This type of evaluation, while time-consuming and expensive, holds, we believe, great potential. Other assessment methods used to evaluate OLI uses of new media are more traditional: pre-test, post-test comparisons, think-aloud protocols, and the like.

New media, in their many forms, do offer education the opportunity to deal both with intractable teaching and learning problems and the economic challenges facing post-secondary education. But the usefulness of each new wave must confront enduring questions. Some of those questions are captured in our "cognitive desiderata" listed above. Others are represented by long-standing best practices in evaluation of instruction. Whatever our personal attraction to virtual labs or immersive digital worlds or multiplayer games, we must keep our eye on the goal—improving learning. The enduring questions provide us with a powerful framework within which to deploy new media in ways that will make a difference in education. That is the thread that should run through the constant change in media that digital technology will bring. The technology changes, but our goals and evaluative standards as educators endure.

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Syllabus 2004

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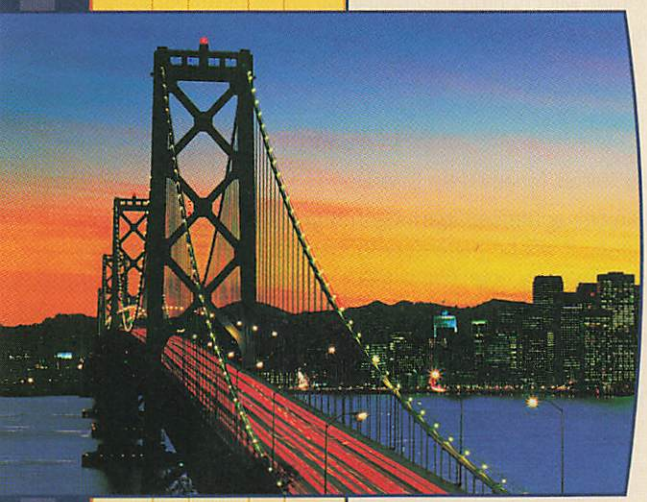

A BRIDGE TO THE FUTURE:

TECHNOLOGIES TO CONNECT THE CAMPUS

CONFERENCE HIGHLIGHTS

- A day at UC Berkeley exploring innovative learning technologies, emerging modes of teaching, and collaborative computing environments
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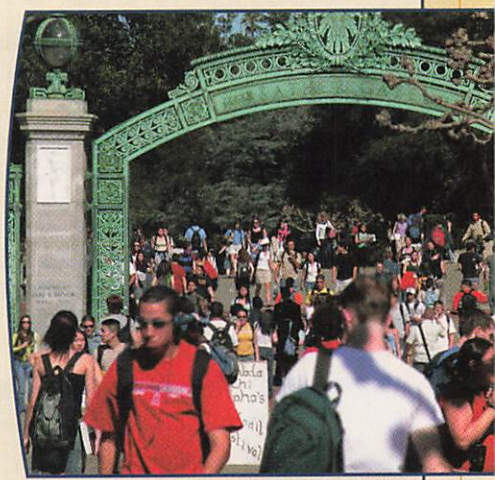

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Keynotes

Monday, July 19

Digital Learning Cultures in the Information Landscape

8:30 – 9:30AM

Clifford A. Lynch, Ph.D. — Executive Director, Coalition for Networked Information & Adjunct Professor, University of California, Berkeley

A number of distinct cultures have evolved concerned with the various aspects of IT-enabled learning: "Learning objects" and the repositories that aggregate them are well established; "Learning management systems" (sometimes called "course management systems" or "virtual learning environments") operate on very different levels of abstraction; the entire evolving infrastructure of digital collections, digital libraries and institutional and disciplinary repositories are now struggling to formulate appropriate linkages with the world of digitally-enabled learning; and, finally, the additional perspectives of scholarly communication and records management are demanding recognition. Lynch will examine these sometimes-competing and conflicting points of view and sketch the developing linkages and relationships among them. He will discuss both the prospects for an effective synthesis of these different perspectives and some of the questions that we need to answer in pursuit of such a synthesis.

UC's Turbulent Times and the Role of IT

11:05 – 11:45 AM

Kristine Hafner, Ph.D. — Associate Vice President, Information Resources and Communication, University of California, Office of the President

Dr. Kristine Hafner will discuss Information Technology's role in the University of California's roller coaster ride through budget and growth ups and downs since the year 2000. She will also discuss the New Business Architecture report, "UC 2010: A New Business Architecture for the University of California", and how it has guided campus and system-wide IT-related initiatives. Hafner will conclude by reviewing some of the strategic IT-related issues that will likely confront the University of California in the next several years.

Tuesday, July 20

Cognitively Informed Online Course Design

8:30 – 9:45AM

Joel Smith, Ph.D. — Vice Provost and Chief Information Officer for Computing Services, Carnegie Mellon University

Many challenges remain in the delivery of effective technology-enhanced learning in higher education. To realize the potential of web-supported learning environments, it will be necessary to make dramatic changes in course development, informed by relevant findings of contemporary cognitive science and learning theory. Digital learning environments can be instrumented to provide multiple, rich feedback loops to students, instructors, and designers. These efforts should be supported and sustained through promotion of cohesive communities of use that represent a more powerful "scholarship of teaching" with online tools. Smith will present these principles in light of his extensive research and work with Carnegie Mellon University's Open Learning Initiative (OLI), a new approach to making web-based courses openly available to any individual learner.

Wednesday, July 21

Can the Internet Survive?

8:30 – 9:45AM

Jeffrey Schiller — Network Manager, MIT

The Internet was originally designed to permit people to use computers that were far away from them. However it quickly evolved into a powerful means of communication between people. Today, a true "Peer to Peer" network has developed, one on which anyone can communicate with anyone else and everyone may publish or consume information. But, that network is under attack. Viruses, worms and the scourge of spam have compromised its nature and put its very existence at risk. The easiest solutions for dealing with these threats could in the end destroy the core values and essence of the network. Schiller will consider better, though more difficult, strategies for securing the continuing usefulness and effectiveness of the Internet.

Thursday, July 22

Wandering the Technology Universe

8:30 – 9:45AM

Annie Stunden — Chief Information Officer and Director, Division of Information Technology, University of Wisconsin, Madison

Take a trip with Annie Stunden from the core of the technology infrastructure to some of the places on the outer edges of our technology universe as we know it today and can envision it in the next year or two. Stunden will talk about building the base that we wander from and where we might meander as we support our students, faculty and staff. She will also talk about some of the perils we encounter and some of the wonders we find as we explore real possibilities and make them our own.

Panel Sessions

Is Open Source in Your CMS's Future? Monday, July 19, 3:30 – 4:45pm

Moderator: Victor Edmonds, Ph.D. — Director, Educational Technology Services, University of California, Berkeley

As course management systems have matured, they've encompassed wider functionality and integrated with numerous other campus systems. As with most large, complex systems, the unbundling of service and software components may produce greater opportunities for efficiencies and customization. Open source efforts in general, and specifically SAKAI, may be the wave of the future for CMS.

Panelists:

Kathy Christoph — Assistant Vice Chancellor for Academic Affairs, University of Wisconsin, Madison
Charles Kerns — Educational Technology Manager, SAKAI Project, Stanford University
Phillip D. Long, Ph.D. — Senior Strategist for the Academic Computing Practice, MIT
Brad Wheeler, Ph.D. — Associate Professor and BAT Faculty Fellow of Information Technology & Associate Dean for Teaching and Learning Technology, Indiana University
Mara Hancock — Associate Director, Learning Systems, Educational Technology Systems, University of California, Berkeley

Pushing Technology into the Background— Services for Useful Collaborations Tuesday, July 20, 4:30 – 5:30pm

Moderator: William H. Riffee, Ph.D. — Associate Provost for Distance, Continuing and Executive Education, University of Florida

The "gee whiz" factor is gone from the transmission and display of data bits, as well it should be. Today's students can rightfully expect technology to serve their needs effectively and unobtrusively. What are the collaborative tools and services your institution should offer, and how can these applications now operate ubiquitously in the background—behind the walls and in the air? This panel will discuss their views on evolving technologies and services.

Panelists:

Lois Brooks — Director, Academic Computing, Stanford University
William Griswold, Ph.D. — Professor, Department of Computer Science & Engineering, University of California, San Diego
Lonnie Harvel — Director, Computer Enhanced Educational Services, Georgia Institute of Technology

Your Campus and the TEACH ACT: Scenarios and Services Wednesday, July 21, 5:00 – 6:00pm

Moderator: Judith Boettcher, Ph.D. — Consultant, Designing for Learning & University of Florida

Come to this session with your questions and suggestions about offering courses online, in view of the TEACH ACT. This panel of experts provides program scenarios and guidelines to help in interpreting the provisions of the Act, including the criterion for e-reserves and also how to cultivate a campus environment that supports faculty and staff knowledge about this important legislation.

Panelists:

Laura Gasaway, J.D. — Director, Law Library & Professor of Law, University of North Carolina, Chapel Hill
John Harwood, Ph.D. — Senior Director, Center for Education Technology Services, Penn State University

Evolution and Innovation in User Support Thursday, July 22, 11:15am – 12:30pm

Moderator: Howard Strauss — Manager, Technology Outreach, Princeton University

Help! There is a growing menagerie of wireless intelligent devices including laptops, PDAs, Blackberry devices, and PDA cell phones on which users expect Web page delivery, email, and the full suite of university applications. Traditional four-year resident students have become the exception rather than the rule. Technological and social changes are radically transforming user support needs. How should IT organizations provide support in this new environment?

Panelists:

F. Meena Lakhavane — Director of User and Educational Services, Carnegie Mellon University
Ricky Telg, Ph.D. — Associate Professor, Agricultural Education and Communication, University of Florida
Mark Veljkov, Ph.D. — Executive Director of Learning, City University OnLine

A Day at UC Berkeley

Syllabus2004 features a day of learning and exploration the University of California, Berkeley, on Monday, July 19.

The Berkeley campus is renowned for its libraries, laboratories, research, and publications, as well as the distinction of its faculty and students.

Included in your registration, this special day on campus affords you the opportunity to see and experience the latest education technology in action, as well as hear from some of the leading scholars on technology in higher education.

Paul Gray, Ph.D., Executive Vice Chancellor and Provost of UC Berkeley will give an overview of Berkeley and some of its programs, followed by Kristine Hafner, Ph.D., Associate Vice President, Information Resources and Communication, University of California, Office of the President, with a special on-campus keynote.

That afternoon you will have the opportunity to participate in a variety of sessions led by UC Berkeley faculty or take a self-guided tour of the campus. For complete details for the entire conference, go to www.syllabus.com/summer2004.

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Beyond PowerPoint:

Building a New Classroom Presenter

By Richard Anderson, University of Washington

"... in the winter of 1813 & '14 , during my first College vacations, I attended a mathematical school kept in Boston by the Rev. Francis Xavier Brosius . . . On entering his room, we were struck at the appearance of an ample Black Board suspended on the wall, with lumps of chalk on a ledge below, and cloths hanging at either side. I had never heard of such a thing before. There it was—forty-two years ago—that I first saw what now I trust is considered indispensable in every school—the Black Board—and there that I first witnessed the process of analytical and inductive teaching." [May 1855]

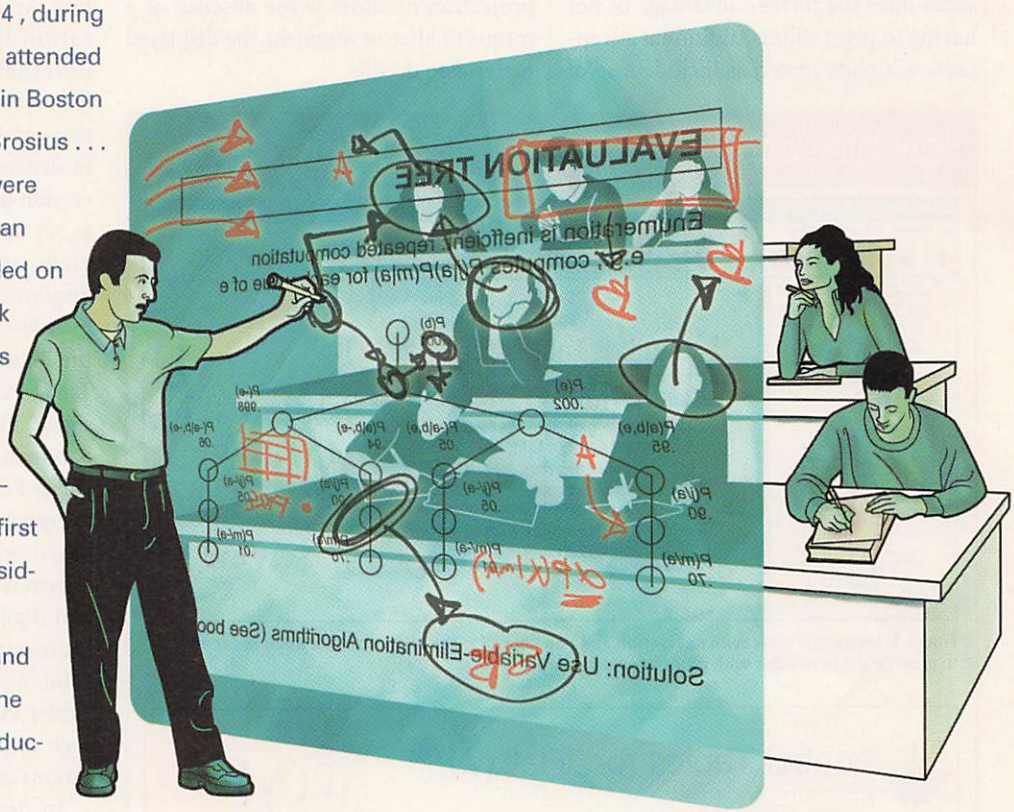


Illustration by Graye Smith

Presentation technology has long had an influence on how we teach. In the wonderful quote above, the abolitionist Samuel J. May described his introduction to the blackboard and its impact on teaching. The quote illustrates a couple of key points: That technology has an important role in supporting classroom instruction, and that technologies perceived as beneficial to instruction will become widely adopted. The blackboard is a very powerful tool for instruction—it allows information to be displayed in a persistent manner, and can give the audience a consistent view of far more information than can be held in short-term memory. The blackboard becomes a mediating artifact that maintains a shared view between the instructor and students to provide context for lecture and discussion.

Stepping forward almost two centuries from Samuel May's visit to Boston, projected electronic slides are becoming an important presentation tool in the classroom. There are some significant advantages to using electronic slides. Slides allow advanced preparation of material, improving organization of the presentation and giving a means of showing information-rich content such as complex tables, formulas, programs, and diagrams. Slides afford instantaneous display, avoiding the inaccuracy and the time of copying material onto an overhead projector or whiteboard. Electronic slides offer the further advantage of not having to print slides. Additional advantages of online materials include ease of preparation, sharing, and modification.

However, these advantages come at a cost in the classroom. Both students and instructors complain about the impact of using slides in lecture. One colleague expressed this directly as, "PowerPoint sucks the life out of a class." The basic issue is that electronic slides tend to script a lecture and do not provide mechanisms to adapt the presentation to the audience. An important part of lecturing is adjusting material in response to audience reactions and developing spontaneous examples and explanations to clarify and expand on topics. The weakness of electronic projection of slides is the absence of a means to alter or augment the displayed material to do this.

Presentation Views

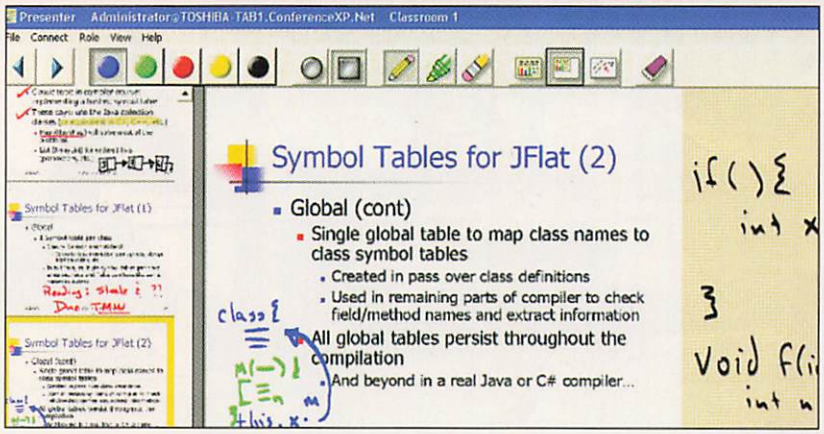

Presenter Administrator@TOSHIBA-TAB1.ConferenceXP.Net Classroom 1
File Connect Role View Help
Symbol Tables for JFlat (2)
Global (cont)
Single global table to map class names to class symbol tables
Created in pass over class definitions
Used in remaining parts of compiler to check field/method names and extract information
All global tables persist throughout the compilation
And beyond in a real Java or C# compiler...

Figure 1. Instructor view with navigation and pen controls. The slide size has been reduced to provide the instructor with extra annotation area.

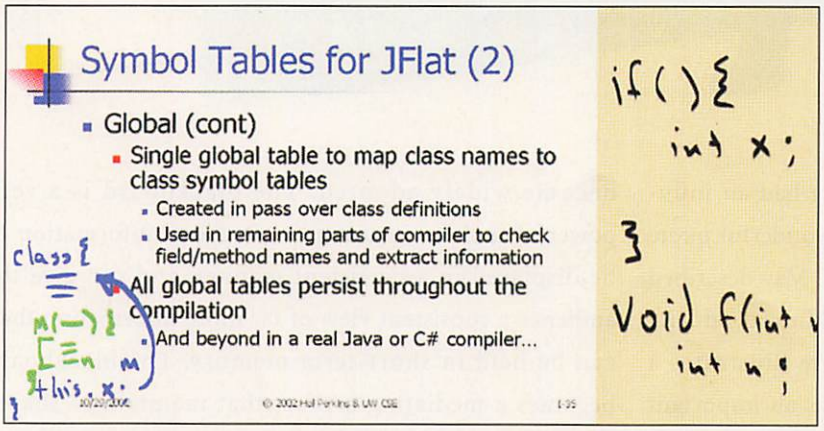

Symbol Tables for JFlat (2)
Global (cont)
Single global table to map class names to class symbol tables
Created in pass over class definitions
Used in remaining parts of compiler to check field/method names and extract information
All global tables persist throughout the compilation
And beyond in a real Java or C# compiler...

Figure 2. Projector view showing only the slide. The Projector view is synchronized with Figure 1's instructor view.

Breathing Life into Classroom Presentations

At the University of Washington, we developed Classroom Presenter specifically to address this problem, and to provide flexibility while using slides. The idea behind Classroom Presenter is simple: support writing on top of slides by using the Tablet PC as the instructor device.

When lecturing using Classroom Presenter the instructor writes on top of images of the slides. These images can either be projected directly from the Tablet PC, or can be shown from a second machine that is networked to the first. An advantage of the latter configuration is that the instructor can be untethered from the projector, and lecture while holding the Tablet PC. The networked version also lends itself to use in distance courses. The single machine version has the advantage of being easier to set up. Figure 1 shows the instructor view, and Figure 2 shows the view displayed on the data projector.

A key part of our system is the use of the Tablet PC as the instructor device. Tablet PCs enable integration of ink with slides, allowing annotation with natural handwriting. The high-quality ink of the Tablet PC completely changes the writing experience from earlier pen computers based on different technologies. (Our system is not unique in combining slides and digital ink using the Tablet PC; an increasing number of other systems combine slides and digital ink using the Tablet PC, including academic systems such as DyKnow, and commercial applications such as PowerPoint and Journal.)

In developing the application, we paid attention to the display of ink on all devices, so that remote displays' ink flows in sync with the instructor's, communicating the direction and speed of writing. A substantial amount of effort went into designing the system as a tablet application. This meant using controls optimized for pen manipulation in a mobile environment. We also designed the system with navigation facilities such as the film strip and direct navigation to a whiteboard.

Classroom Presenter has been used in a wide range of Computer Science courses at UW and other universities. Courses have included introductory programming, data structures, software engineering, and computer architecture. Both instructors and students have been very positive about the system. Typical instructor comments include: "It didn't take any adaptation. I just talked/ discussed and when I needed an example, I wrote. As easy as using the board," and "Being able to diagram and spontaneously work examples instead of having to use a pre-scripted PowerPoint slide deck—felt like teaching a real class."

Connecting with Student Devices

As one would expect, instructors have made varied use of the system. Some instructors have made extensive use of ink on slides, while others have retained a slide-based style with only occasional marking. In presentation, ink is used both to convey information directly with text and diagrams, and to link speech to slides through attentional markings. Figures 3 and 4 show examples of usage from actual classes. In both of these examples the meaning of the writing was dependent on the spoken context and is not conveyed in the static image. Digital ink has allowed instructors to conduct many activities not supported by electronic slides alone, such as a "collective brainstorming," where answers that students speak out are written down and "process simulation," where ink is used on top of a diagram to show a dynamic process. It has been observed that ink is often used when responding to student questions. This supports the view that the value of ink is in supporting spontaneous acts by the instructor. One interesting pattern of use of ink that has been observed across instructors is frequent underlining and circling when talking about mathematical formulae or program code, as in Figure 3. This is done to give a persistent tie between speech and slide

continued on page 49

Classroom Applications

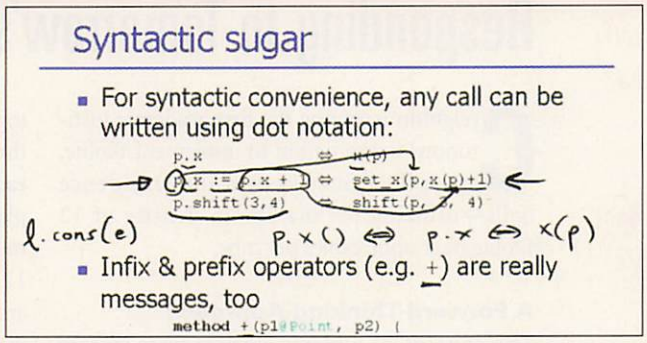

Syntactic sugar
For syntactic convenience, any call can be written using dot notation:
p.x
p.x := p.x + 1
p.shift(3,4)
set_x(p,x(p)+1)
shift(p, 3, 4)
l.cons(e)
p.x() ⇔ p.x ⇔ x(p)
Infix & prefix operators (e.g. +) are really messages, too
method +(p1:Point, p2) {

Figure 3. Example of writing from classroom use showing how an instructor works with formulas during presentation.

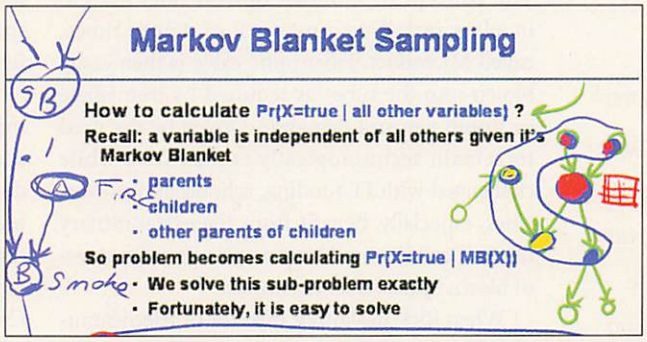

Markov Blanket Sampling
How to calculate Pr{X=true | all other variables} ?
Recall: a variable is independent of all others given it's Markov Blanket
· parents
· children
· other parents of children
So problem becomes calculating Pr{X=true | MB(X)}
· We solve this sub-problem exactly
· Fortunately, it is easy to solve
Fire
Smoke

Figure 4. Example showing multiple diagrams on slides used in explanation of the formula.

1. Why are more colleges and universities choosing Xythos for digital lockers and secure campus collaboration?

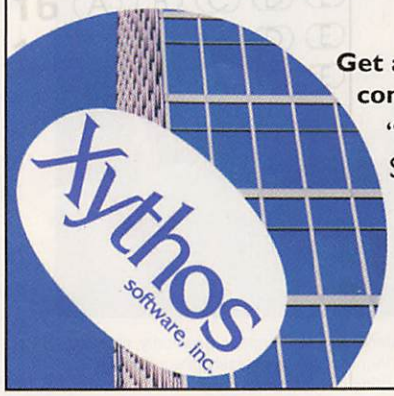
Ⓐ It makes sharing documents & files easier

Ⓑ It's a lot safer than email

Ⓒ It's the easiest to deploy and support

Ⓓ They saved a lot of money

Ⓔ All of the above



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- **Creighton University** adopted a new standard for future network upgrades and installation on campus.
- **York University** launched a pilot project using Sonic Foundry's Mediasite Live to capture, stream and archive lectures.
- **Saint Joseph's University** combined the traditional methods of teaching with the latest technology to create an interactive learning experience.
- **Harvard Life Sciences** implemented a new storage system to support their growing data loads.

Creighton University ▪ By Brian A. Young

Responding to Tomorrow's Technology

Creighton is among the first academic institutions in the nation to implement Blolite, an optical fiber system into residence halls—utilizing the maximum density of 12 Blolite fiber optic cables per tube.

A Forward-Thinking Approach

The concept of a blown optical fiber system involves installing a network of empty tubes, called Microduct. Fiber optic cable is then easily blown into the tubes as required by immediate or future network demands. Driven by the need to remain technologically competitive while challenged with IT funding, schools and universities, especially, benefit from the extraordinary design flexibility and "pay-as-you-grow" features of blown optical fiber networks.

When Rick Brokofsky, director of telecommunications at Creighton University encountered General Cable/NextGen Fiber Optics' Blolite blown optical fiber system (www.blolite.net), he was captivated by the technology and what it could mean for Creighton University. In a Blolite system, sections of Microduct tubes are joined together with push-fit connectors and installed throughout the campus to extend pathways to each network destination. Once the tubes are in place, a two-person crew uses specialized equipment that delivers compressed air to propel up to 12 optical fibers through each tube. Only the amount of fiber required by the network at the initial installation is blown into the tubes while spare tubes remain empty to accommodate future fiber installations.

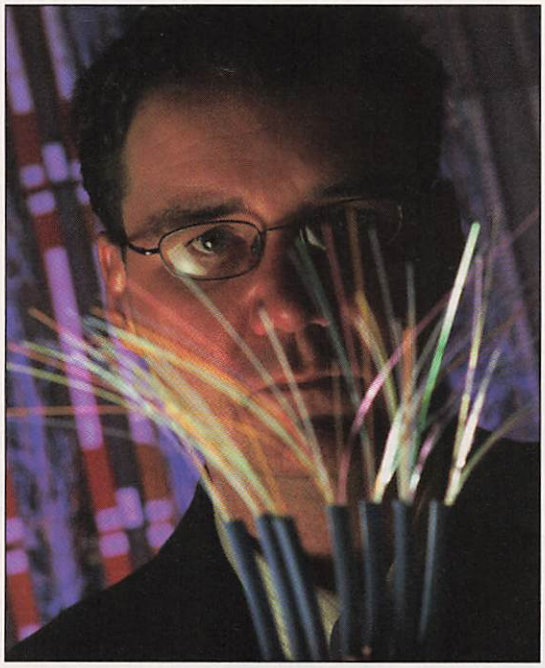
Although fiscal limitations can often impede initial spending, a network infrastructure should be considered a long-term investment designed to support future network requirements. Because the information-carrying capacity of fiber optic cabling is essentially infinite, a blown optical fiber system will support Creighton for several decades. "For maximum cost effectiveness as we remodel or build new campus buildings, we have to strive to make them technologically sound for a minimum of 30 years," says Brokofsky.

The built-in adaptability and capacity of a blown optical fiber infrastructure provides complete design control now and in the future, ensuring maximum bandwidth for the highest value with the lowest possible risk. This gives Creighton a competitive advantage. Because the rate of technological change is increasing and network capacity is essential to enhanced learning, teaching, and campus communication, a flexible network design that allows for virtually unlimited growth in a simple, cost-effective manner is key to Creighton's future.

An Ideal Infrastructure

Using blown optical fiber technology, Creighton University is currently upgrading its network infrastructure to a true star configuration, with the center of the star located in the lower level of the Reinert/Alumni Memorial Library, in the heart of the main campus.

When campus expansion called for the construction of the new Hixson-Lied Science Building, Brokofsky specified the Blolite blown optical fiber system to connect the new building to the campus network. Creighton University's recently renovated Rigge Science



Photos Courtesy of Creighton University

Brian A. Young, vice president for IT at Creighton University, pictured with Blolite blown optical fiber that will seamlessly integrate technology into Creighton's learning environment.

Center and Criss Medical School are also connected to the network via several spare and populated tubes and nearly 70,000 feet of Blolite fiber.

Following completion of the new science complex, Creighton University adopted a new network standard of at least one Microduct tube for every room. "At least one outlet in every classroom, office, and laboratory will have a spare tube for future fiber connectivity," says Brokofsky. "Our minimum standard to the renovated residence life areas consists of three Category 6 cables, one coaxial connection for CATV, and one Microduct tube."

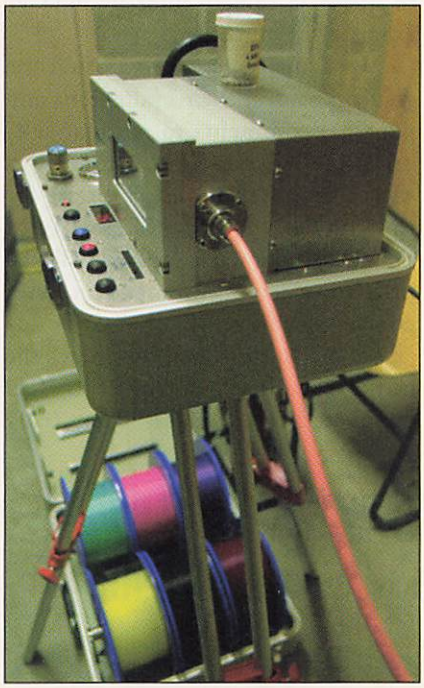
Creighton University is one of the first educational institutions to bring blown optical fiber into residence halls to ensure that students continue to have 24/7 access to the latest technology in all areas of the campus. Three new multi-bedroom residence halls for junior and senior students are connected to the network with blown fiber and include one empty tube to every "pillow" as part of the new standard.

A Future Cost Advantage

Information technology improves and strengthens all aspects of the academic environment. As computing applications become central to student life, enhanced teaching, better research, and improved administration operations, all members of the university will continually require improved technology, network uptime, and increased bandwidth. Therefore, the process of planning a campus network requires participation of all stakeholders and a funding strategy that covers continual network growth. A blown fiber system is a financially strategic approach that provides built-in network capacity.

Future network requirements can be difficult to determine, and Brokofsky admits that choosing a blown fiber system has put an end to the uncertainty of how many and what types of fiber to install. By allowing the university to install only the fiber needed today and easily add fiber to spare tubes in the future, blown fiber eliminates the cost, time, and guesswork associated with future proofing by installing dark (unused) fiber.

Because technology is rapidly evolving and academic environments like Creighton are prone to frequent moves, adds, and changes (MACs), the ideal campus network should easily accommodate modifications and the replacement of obsolete technology with as little down-



Compressed air is delivered to propel up to 12 optical fibers through each Microduct tube.

time as possible. With a blown fiber system, the existing infrastructure of tube pathways is already in place, which means minimal disruption to the physical environment of the campus during MACs. "Adding additional blown fiber requires much less labor cost than installing conventional fiber optic cable and allows us to get the network up and running that much faster. It's not at all disruptive to our campus life," says Brokofsky.

In a Blolite optical fiber system, obsolete fiber can be easily blown out of populated tubes and new fiber blown back into empty tubes when network requirements have changed. This saves on the labor costs associated with removing the obsolete fiber. While blowing a maximum of eight fibers per-tube was common practice at the time of the initial installation, Brokofsky had 12 Blolite fibers blown into populated tubes for maximum cost effectiveness. Creighton University is the first academic facility in the United States to blow all 12 Blolite fibers into the Microduct tubes, the highest fiber density available.

A Concept to Grow On

Moving forward, Creighton University plans to deploy the Blolite blown optical fiber system for its entire data network. Plenty of spare Microduct tubes will provide a way to easily expand the campus network, positioning the university for success in the 21st century and ensuring that students have access to nationwide and worldwide information and resources. An upcoming eastward expansion of the campus will include 28 Microduct tubes and over 250,000 feet of Blolite fiber for several buildings, including a new soccer arena.

Creighton University programs in medicine and dentistry involve research-based application access to remote devices at high speed, the movement of large-scale files, and even video conferencing. "We're performing significant amounts of imaging here like sending X-rays and EKGs over the network, and the growth in these types of applications is enormous," says Brokofsky. "With a blown optical fiber system, we're ready to increase bandwidth and go to 10GB whenever these applications call for it."

In addition to data, Creighton serves cable TV, remote telephone switches, environmental controls, CCTV, door access systems, and even the student debit card system for vending machines, laundry, and other purchases over its fiber network.

While bringing fiber to the desktop will not take place for quite some time, Brokofsky knows that technology is changing fast and that sufficient bandwidth is key to the evolution and improvement of every Creighton initiative.

***Brian A. Young (bay@creighton.edu)** is vice president for information technology at Creighton University.*

York University ▪ By Dalton Kehoe

Educator, Students Provide Frontline Perspectives

Based in Toronto, Canada, York University (www.yorku.ca) has an expanding enrollment of more than 40,000 students. An inevitable consequence to its growth is overcrowding—both in the lecture halls and the parking lots. The majority of the undergraduates are commuters, including mature students trying to balance career, family, and education.

Many of York's professors and administrators believed that providing a multimedia online learning venue would address the university's growing pains and even improve the quality of students' education. However, they wanted an online system that did not create additional work for the faculty.

Students Give Online Learning High Marks

In the fall of 2002, York University launched a pilot project using Sonic Foundry's Mediasite Live to capture, stream, and archive the lectures for a popular, two-semester social sciences course that I teach. As a long-time advocate of education technology, I was excited to be the first professor at our university to use the system.

There were 200 traditional, classroom-based students and 50 students who accessed the weekly two-hour lectures online. Because Mediasite Live captures the speaker in both audio and video, and automatically indexes and synchronizes that information with virtually any visual instructional content from the class, each group received identical information. The eLearning students were still required to attend on-campus tutorials and take exams at the university.

I was surprised by how often the students said in their evaluations and personal comments to me that self-discipline was a key factor in being a successful distance learner. Praise for the convenience and flexibility of online learning was tempered with the proviso of having to make an extra effort to stay focused.

Another surprise was how much the online students needed to feel connected to the class. They truly appreciated that I acknowledged them during the lectures, even if I couldn't actually see them. It started as a casual occurrence during the first term, but the positive response from the students encouraged me to make name recognition a standard practice thereafter.

The majority of students agreed that the online version forced them to be self-motivated in taking charge of their education.

From Fear Factors to Success Factors

The one big complaint about any technology-based teaching aid is the extra work created for educators. Professors fear they will need to re-create all of their instructional material, or perhaps change their whole style of teaching in order to provide a quality education experience for the burgeoning number of online students.

In the world of high technology and teaching, when a new application is introduced, there is always huge hype about its ease-of-use and about the variety and quality of learning tools it contains. Then reality clashes with fantasy, and there is the inevitable disappointment.

Mediasite Live is an exception to that rule. It worked smoothly from the beginning, performed exactly as promised and didn't get in the way of what or how I teach. It was fun for my students and for me.With eagerness from the students about the technology, and since no additional work was required on my part, York bought four more Mediasite Live systems.

This enabled the university to expand online learning opportunities to other courses within the social sciences division and across campus, starting with the Fall 2003 semester. In addition, the university's Career Services Department is maximizing resources by offering 12 Web-based workshops for students. This frees the career counselors to spend more time on "high-touch" services (situations where students receive one-on-one personalized attention, such as career advisement, administering of self-assessment tests, critiquing resumes, and interview role-playing).

Finally, a well-designed, content-rich Web site is vital to a successful distance education experience. We created the site (www.calumet.yorku.ca/sosc2311/) for our pilot eLearning hybrid course as a one-stop-shop that provides not only the streamed lectures, but all the support material as well. With the right tools in place, educators can be more effective and reach a greater number of eager students.

Dalton Kehoe (dkehoe@yorku.ca) *is an associate professor of Communication Studies at York University in Toronto Ontario, Canada.*

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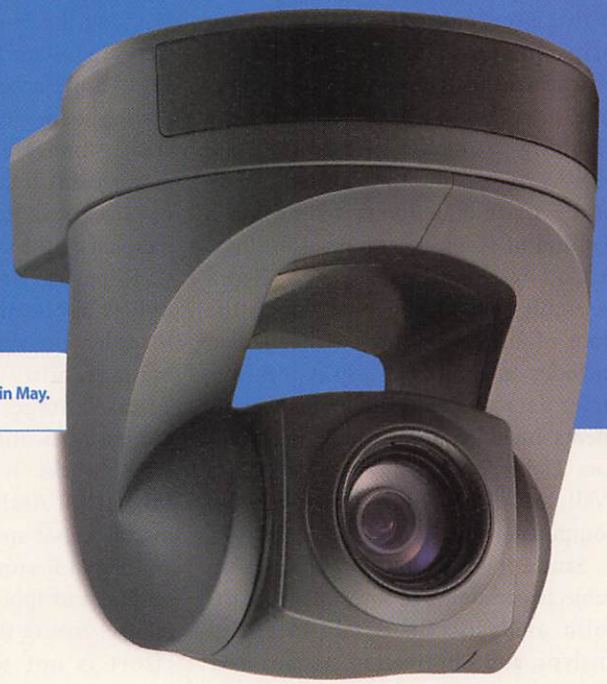

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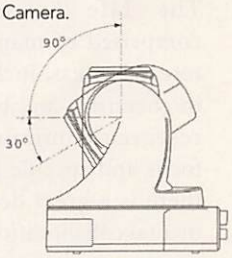

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St. Joseph's University ▪ By Joseph A. DiAngelo

Upgrading the Traditional Experience

The Erivan K. Haub School of Business at Saint Joseph's University mission is to provide students with a program that enables them to bring the most innovative business practices to their professions. To simulate a real-work environment for teaching principles of business, the Haub School of Business created a state-of-the-art Trading Room, joining only a handful of similarly equipped business schools in the world. The Trading Room resembles what one would see on the floor of any major stock exchange and includes capabilities to display real-time price data on many financial instruments. Included in the room are a Trans Lux Ticker Board, Picture Wall, Data Wall, and IBM ThinkCentre desktop computers with 17-inch flat screens.

Students enrolled in courses in subjects pertaining to investments, portfolio analysis, financial statement analysis, and information systems have the opportunity to take advantage of the real-world financial simulation environment provided by the Trading Room.

Using the Financial Trading System software installed on each of the room's IBM ThinkCentre desktops, students can participate in mock trading transactions, create simulated portfolios, access past and present financial data, and obtain news coverage from domestic and international markets.

To ensure the availability of technology applications to students, Saint Joseph's University uses innovative manageability tools, such as IBM's ThinkVantage Technologies, which diminish downtime and maintenance of PC networks. Technologies like System Migration Assistant, which quickly migrates user-specific data and settings and Rapid Restore, which recovers data, settings and applications after a software failure, ensure that students' time and effort is not wasted or lost when completing research and assignments.

The "smart classrooms" have Ethernet ports, audio conferencing, projectors and cameras.

By investing in technology, Saint Joseph's University has invested in its students, differentiating them from their peers and placing them a step ahead in their future professions.

Joseph A. DiAngelo (jodiange@sju.edu) is dean of the Erivan K. Haub School of Business at Saint Joseph's University.

Harvard Life Sciences ▪ By James Reaney

Harvard Tackles Storage Issues

The Life Sciences program is comprised of many interdisciplinary research areas, including departments in chemistry and biology. While every research community has a unique focus and specific projects of interest, there is a great deal of cross-departmental collaboration and shared initiatives among our thousands of researchers and scientists. A vital technology priority among the various Life Sciences areas is the need for fast and efficient data storage.

The Technology Dilemma

Steadily increasing research data requirements within the Life Sciences mandated a better mass-storage system, one beyond the traditional, limited direct-attached storage and network-attached storage (NAS) options used by many research departments.

Our existing storage systems were not scalable; there was a limited quantity of storage available to each server and no effective way of centrally managing the proliferation of independent storage solutions. We found that while we could always buy larger drives, we were hitting the manageability and scalability limits of the drives that could be attached.

While there was the option to purchase storage-area network (SAN) capability through Harvard's central IT services, the cost was deemed prohibitive and the available capacity wouldn't meet our future storage needs.

Any new data storage solution would first have to interact seamlessly with the Life Sciences' heterogeneous client environments. In addition, we had three specific criteria for our storage needs: scalability, performance, and cost. We also wanted flexibility, the capability to have both fast Fibre Channel and slower, less-expensive ATA storage managed together. We needed a vendor whose system could scale as high as possible, because we don't know how many users would be involved in our community's future.

Harvard Life Sciences ultimately determined that building a SAN fabric was too expensive, both standalone

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SONY

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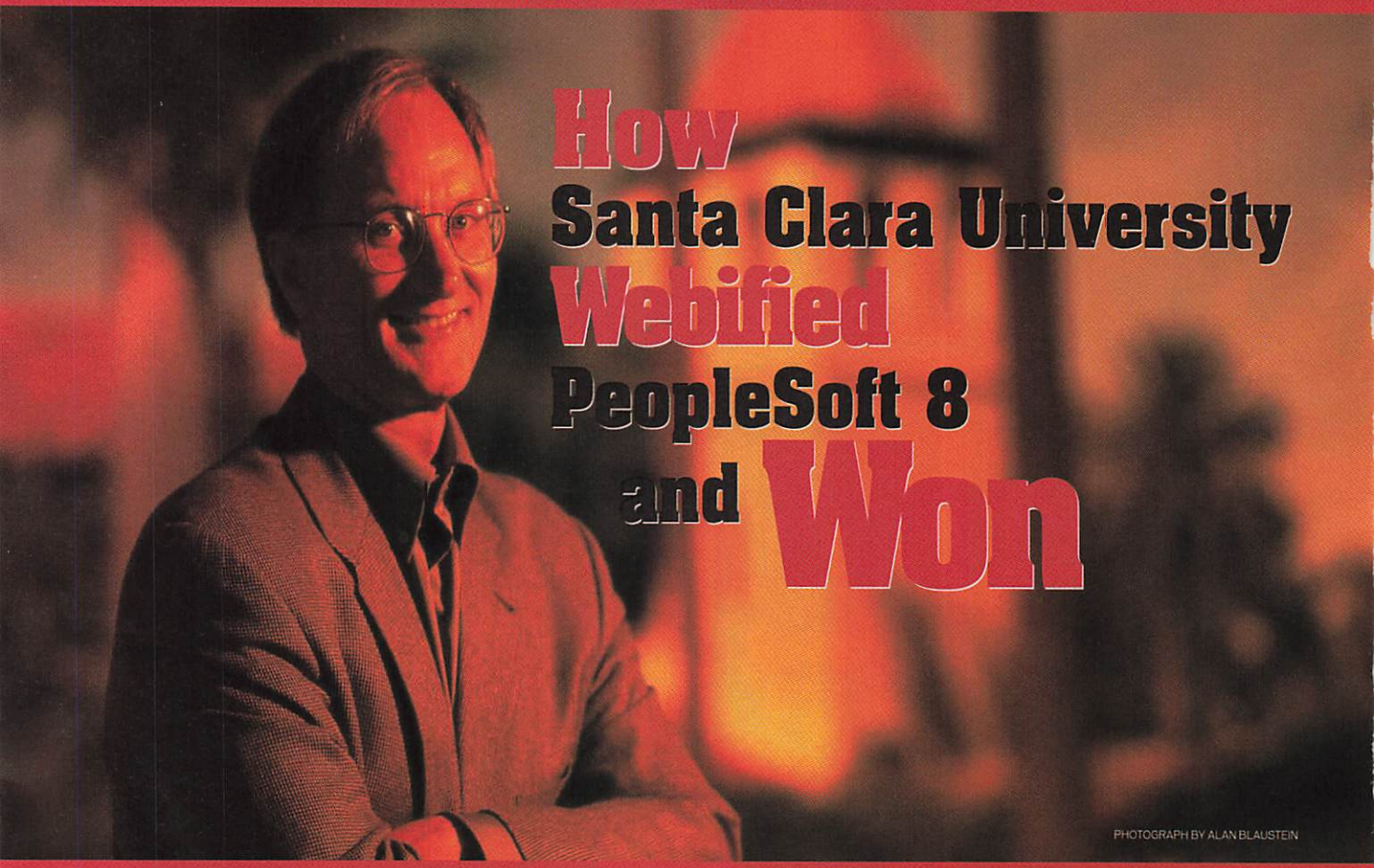


How Santa Clara University Webified PeopleSoft 8 and Won

PHOTOGRAPH BY ALAN BLAUSTEIN

CIO Ron Danielson's Triple Play of Bandwidth Savings, Increased Server Capacity and Extended Life Cycle.

THE IDEA was to provide more widespread access to business-critical enterprise applications without increasing the administrative burden on the IT department. Before that goal would be realized, however, Santa Clara University (SCU) got a lesson in what can go wrong with Web-based applications and, more importantly, how to remedy the problems.

In July of 2002, SCU made the move to PeopleSoft 8, the Web-enabled version of the popular application suite. The school uses PeopleSoft to support human resources, financial and student administration applications, including admissions, financial aid and course registration programs, says Ron Danielson, chief information officer for SCU, an 8,000-student university in Santa Clara, Calif.

"As much as we possibly can, it's our intention to push access to administrative information out to students, faculty and staff," Danielson says. With the previous version of PeopleSoft, that was a challenge because it required client software on each user's desktop. "With the Web front end, anybody with a browser can come in and get access."

Access they did, so much so that the university's application servers were overloaded and performance was much slower than with the previous version. "We were one of the first half-dozen universities in the country to upgrade to PeopleSoft's new Web-based product, and we thought we'd spec'd out our network and equipment adequately to meet our performance needs," he says. "But we weren't even close."

SCU'S REDLINE BENEFITS AT A GLANCE:

- **Bandwidth reduction: E|X 3250 reduces bandwidth requirements by up to 10M bit/sec, saving SCU at least $48,000 per year.**
- **Increases server capacity: Offloads connection management, I/O and SSL processing, essentially cutting server loads in half.**
- **Reduces number of network components: Reduces the amount of data traffic, enabling network components such as firewalls to handle more load.**

IN SEARCH OF A FIX

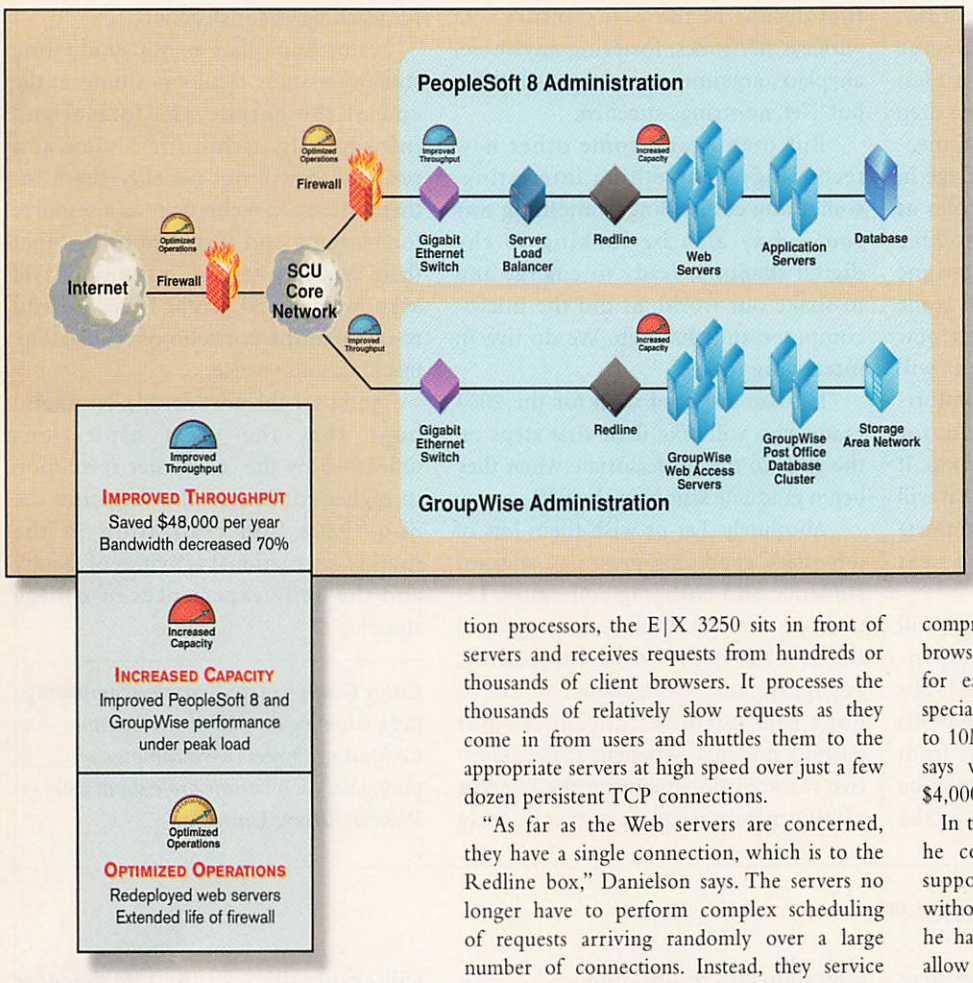
Initially, Danielson and his staff tried throwing more hardware and software at the problem. To an initial configuration of one Web server and one application server, they added three more Web servers and one new application server. They also brought in performance management and software tuning tools, and changed some PeopleSoft parameters related to processing input from users.

"This brought performance to an 'acceptable' level," Danielson says. "But now we had six servers instead of two, and we were still spending a lot more time on the problem than we would have liked."

In the fall of 2002, the university learned about Redline Networks of Campbell, Calif. Redline makes a family of appliances designed to improve Web-based application performance by offloading from the server I/O processing and connection management chores, while compressing content to conserve bandwidth. The appliances also handle Secure Sockets Layer (SSL) processing, thus serving to improve security.

LESS BANDWIDTH, MORE PERFORMANCE

In November, SCU installed one of Redline's E|X 3250 appliances and saw an immediate,



dramatic improvement. Bandwidth usage associated with the PeopleSoft applications plummeted by 70%, thanks to the compression features inherent in the E|X 3250. At the same time, because the E|X 3250 handled connection management chores and I/O processing, server capacity effectively doubled.

The magnitude of server capacity and performance improvements hit home when one of the university's servers went down for more than a week. "We didn't even notice a change in performance," Danielson says. "That tells us how much headroom the Redline box has given us with our PeopleSoft applications."

Like the rest of Redline's enterprise application processors, the E|X 3250 sits in front of servers and receives requests from hundreds or thousands of client browsers. It processes the thousands of relatively slow requests as they come in from users and shuttles them to the appropriate servers at high speed over just a few dozen persistent TCP connections.

"As far as the Web servers are concerned, they have a single connection, which is to the Redline box," Danielson says. The servers no longer have to perform complex scheduling of requests arriving randomly over a large number of connections. Instead, they service each response as it arrives and send information back to the enterprise application processor, which delivers pages to the client browser at whatever speed the browser can efficiently handle.

The E|X 3250 worked so well for SCU's PeopleSoft implementation that the university soon installed an additional unit to improve the performance of Novell GroupWise servers that provide Web-based e-mail access. Here the E|X 3250 sits in front of four servers, performing load balancing, connection management and compression. For its GroupWise application, the university also takes advantage of the E|X 3250's SSL offload capability, which obviates the need for the servers to maintain large amounts of user data, including client certificate information. It also ensures that end users have no direct access to the application servers and the often-sensitive information they contain.

Results from the GroupWise implementation have been similar to those for PeopleSoft: bandwidth consumption on the university's WAN links has been cut in half and response time has improved.

SAVINGS, SAVINGS, SAVINGS

The bottom line, Danielson says, is that the Redline appliances enable SCU to realize savings in three areas: bandwidth reduction, increased server capacity and extended life cycle of other network components.

Bandwidth savings come from the compression features of the appliance, which are browser-aware to adaptively compress content for each requesting user and never require specialized client software. The features save 6M to 10M bit/sec of bandwidth, which Danielson says would cost the university an additional $4,000 to $5,000 per month.

In terms of server capacity, Danielson figures he could remove two of the four servers supporting his PeopleSoft implementation without suffering a performance hit, although he has opted to leave the installation as-is to allow for anticipated growth in the number of applications and users. Similarly, on the e-mail side, "We probably won't have to grow that server farm dramatically to handle additional load," he says.

Just as the Redline appliances enable him to get more life out of his servers, they do the same for network components such as firewalls. "With the Redline box reducing bandwidth usage, there's less for the firewalls to examine," so a single firewall can effectively handle more load.

In coming months, SCU will be adding to its Redline implementation another server group that supports university financial applications.

To sum up, Danielson says, "This box delivers on all its claims."

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Digital Tweed, *continued from page 18*

discipline—for example, philosophy, psychology, or physics—the degree completion rates and career paths are less certain for the students lured by the siren song we may sing about life in academe.

The 2004 grads have come of age in an era of technology. In their roles as research and teaching assistants over the next few years, and when they assume their first academic appoint ments at the end of the current decade, their new colleagues and hiring institutions will assume they "know" and "are comfortable" with technology—as a tool for research, scholarship, and instruction. It may not be a fair assumption, but it will be there, an inferred part of the portfolio, an essential tool for the next generation of faculty.

We know that the technologies will change—get faster, better, less expensive—in the coming years. The 1980s gave us the microcomputer; the 1990s brought us the Web. A few years from now the conventional wisdom may be that the compelling technology of the first decade of the 21st Century was wireless networks, fostering anywhere, anyplace, anytime connection—nothing but 'Net, no strings attached.

But then again, some other new technology—something interesting, something compelling, something *way cool*—may also be lurking in the digital shadows, ready to emerge and to shake our world, as did the microcomputer and the Web. We do live in interesting times.

Is there a special wish for the 2004 grads who will take their first steps on the path to the professoriate when they begin graduate school in the fall?

Absolutely. Let us wish them lots of job offers, good jobs, great pay, engaged students, and engaging colleagues. Let us hope the emerging technologies of this decade prove to be compelling, engaging, and less expensive. Let us hope that our new colleagues—our current students —benefit from definitive research documenting the benefits of information technology as a resource for teaching and instruction.

Let us hope that as our graduating students assume faculty positions at the end of the decade, the formal and informal algorithm for review and promotion will not penalize them for their interest in technology as a resource for teaching and instruction, and that their departments and institutions will acknowledge and accept IT as a useful resource in the portfolio of scholarship, teaching, and service.

And over the next decade, let us also hope that the great aspirations unleashed by the "computer revolution in higher education" that began in the mid-1980s find realization in the routine instructional activities of faculty and the daily experiences of college students.

***Casey Green (cgreen@campuscomputing.net)**, founding director of the Campus Computing Project (www.campuscomputing.net), is a visiting professor at Case Western Reserve University.*

CASE STUDIES, *continued from page 38*

NAS and direct-attached storage were far too limited, and that a hybrid NAS-on-SAN approach would give the most flexibility and scalability for considerably less cost.

We chose the BlueArc Titan SiliconServer, a modular network storage system that can fetch and retrieve data from disk arrays at extremely high speed and manage the data loads under a single file system. Titan can handle 256 trillion bytes of information. Its special programmable architecture transfers data to drives at 5Gbps, and BlueArc is aiming to hike that speed to 20Gbps in the near future.

Titan's hardware-based Silicon File System uses virtual volumes to partition data for users, groups or departments—allowing storage administrators to dynamically expand and contract storage allocations to meet individual needs. This eliminates downtime that many other systems require due to data migration and reallocation.

With our new Titan systems, Harvard Life Sciences already has 28 terabytes of mixed Fibre Channel and ATA storage, all managed together. We are poised for quick growth and can use our storage solution for a wide range of needs—from traditional file and database services to replacing old, expensive tape backup solutions, even as a fail-safe mechanism for disaster recovery at an off-site location.

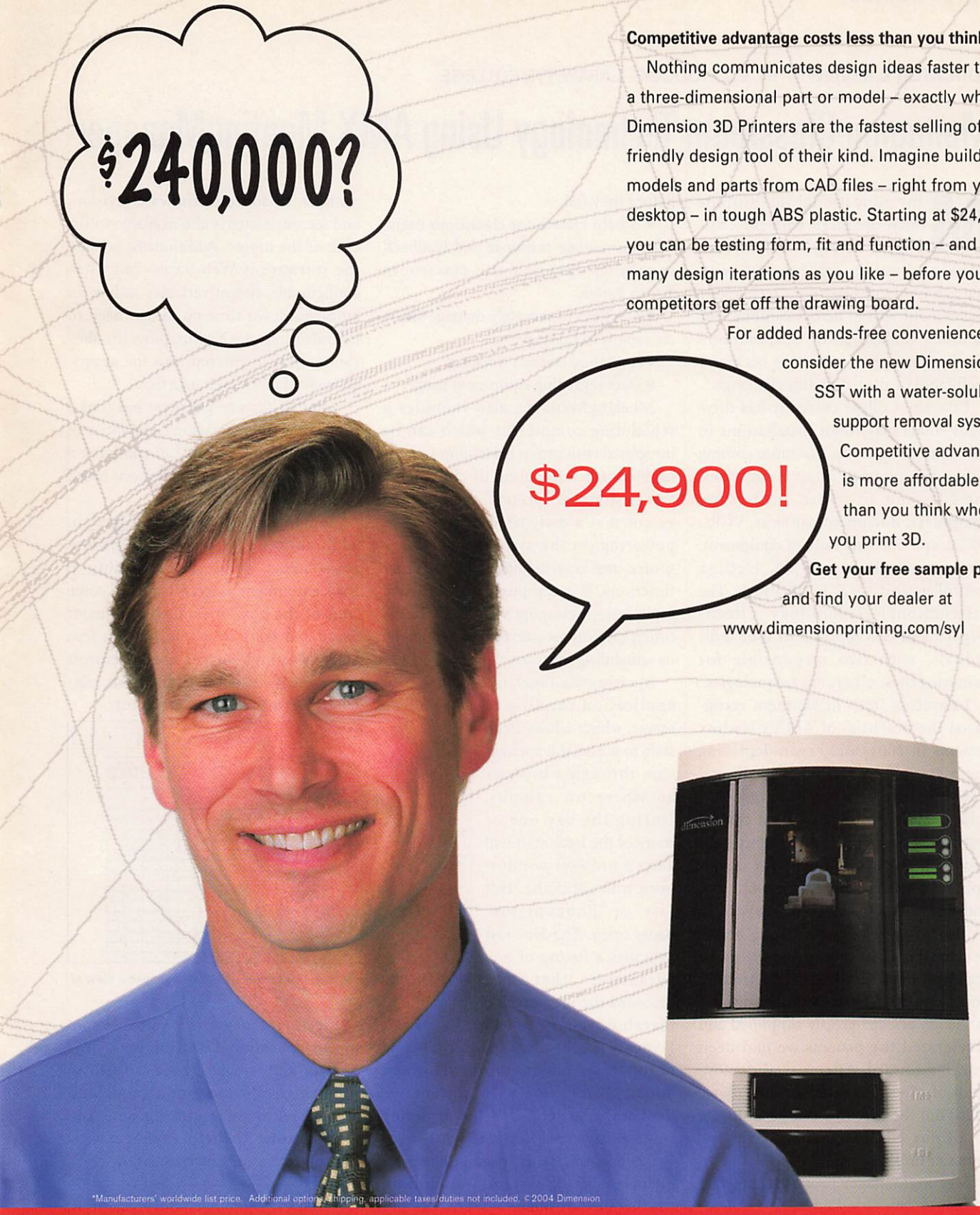
Future storage needs are no longer a worry, as Titan allows Harvard Life Sciences to grow our mass-storage solution without requiring purchase of additional controllers—a key differentiator from other vendor options.

Our community will benefit from Titan's modular blade architecture that provides investment protection—including upgrades to new technologies like 10Gb Ethernet. In addition to its technical capabilities, the BlueArc system will eventually save the Life Sciences Program millions of dollars, as our teams will be able to consolidate our hundreds of terabytes of direct-attached storage spread across thousands of servers.

Cost savings also filter down to our user base, because users no longer need to buy their own individual, limited, backup or mass-storage solutions. This is basically a shared resource among all of our researchers.

We expect that the Titan product will provide a fourfold increase over our current performance metrics and that performance will only increase as we upgrade our Ethernet networks to support 10GB capabilities. We've been extremely pleased with our choice and the solution that BlueArc has been able to provide.

***James Reaney (reaney@mcb.harvard.edu)** is Life Sciences Network and Server Operations Manager at Harvard Life Sciences in Cambridge, Mass.*



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EDUCATOR'S REVIEW ■ BY E.J. HUDOCK—LAFAYETTE COLLEGE

Managing Classroom Technology Using AMX MeetingManager

Many educational institutions today are faced with the challenge of having a small instructional technology staff tasked with managing a large classroom technology deployment spread across campus. For Lafayette College, AMX Corporation's MeetingManager software has become a useful tool in alleviating this challenge.

Lafayette College currently has fifty-eight smart classroom installations in twelve buildings, with five more coming online this summer. These installations include one or more projectors, computers, document cameras, VCRs, DVDs, and other specialized equipment. The rooms all have AMX Netlinx controllers and AMX Touch Panels. The Instructional Technology (Itech) Department is comprised of four individuals, with two responsible for managing these classroom technologies.

Lafayette's Itech department recognized the potential of AMX's Netlinx systems in 2001, and began deploying them as the basis of what we hoped would become an enterprise-grade A/V solution. Having the classroom control systems as devices on the campus LAN provided the groundwork for developing a remote management solution, and so, in 2002, Lafayette along with its AV Integrator, Vistacom Inc., began developing custom code modules to accomplish those goals. The introduction of AMX's MeetingManger software in the fall of 2003 greatly simplified and accelerated the process we had been working toward. After a trial deployment of nine classrooms in the fall, we rolled out the MeetingManager software to all our Netlinx systems over the semester break.

MeetingManager provides Lafayette with:

- Real-time monitoring of system status, including notification of imminent problems in certain devices before they fail
- A help system for classroom users, with immediate response and feedback capability through the classroom Touch Panels
- A system to remotely manage smart classroom technology
- A method of asset tracking
- Data regarding equipment usage

MeetingManager also includes a scheduling component which can be integrated with group messaging systems to allow for scheduling of classrooms and creation of "presets" these can be executed at a designated time, such as powering on the system, selecting a source, and lowering lights, among other functions. If a campus does not use a groupware messaging system, the institution can import a text file generated by its scheduling software.

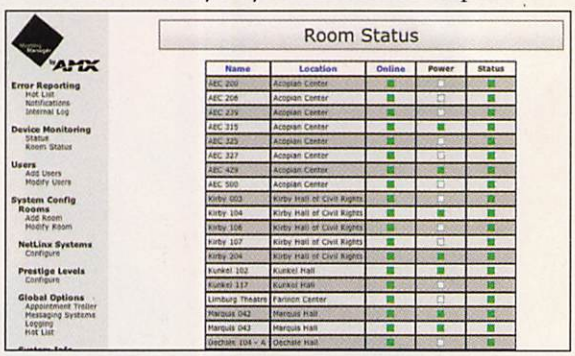
MeetingManager is a Web-based application running on a Windows server, which allows Itech staff to access the application through a browser anywhere on campus. During the day one or more of the Itech staff will keep a browser window open with either the "Hot List" or "Room Status" pages open. The Hot List provides a listing of any parameter that has exceeded the user-defined thresholds. For example, a "Help Request" is generated if a user hits one of the "Help" buttons on the classroom Touch Panel, or a "Maintenance Request" is generated if the projector lamp hours exceed a defined value.

The "Room Status" page provides an overview of all systems—including whether they are online, powered on, and their current status. The data on these pages is refreshed every thirty seconds.

Information such as system serial number, IP address, firmware revision, and security status is also available with a click of the mouse. Additionally, because the software is Web-based and user-configurable, system variables such as an auto-shutdown time no longer need to be coded into the Netlinx program; they can simply be entered into the appropriate field in the Web interface.

Another feature Lafayette has found valuable is the messaging capabilities of the software. We are able to configure a matrix of communication options based on rooms or defined users.

Additionally, all events are logged. In addition to help requests and maintenance items, we use this capability to track equipment usage. Six reports come "out of the box," including equipment usage and lamp hours, to name a few. Since MeetingManager uses Microsoft Access as its database engine, it is relatively easy to create custom reports.



MeetingManager provides a continuously updated snapshot view of room status.

MeetingManager is a valuable tool for an educational environment. It is a true enterprise-grade solution, supplying real-time, empirical data to evaluate return on investment, and easy-to-use tools to help manage your campus technology investment.

E.J. Hudock (hudocke@lafayette.edu) is the instructional technology facilities coordinator at Lafayette College in Easton, Pennsylvania.

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bandwidth hungry | ~~no mac support~~ | ~~needs a network~~ | **can't show visuals**
no flexibility | ~~can't navigate content~~ | ~~time consuming~~ | ~~tough to integrate~~
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PRODUCT GUIDE

A Resource for Technology Leaders in Higher Education

	PROJECTORS
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Mitsubishi's XL5900U/LU LCD ColorView Projector	The first conference room and boardroom installation projector available in the market with a built-in motion-sensitive, anti-theft alarm for investment-protection.
Mitsubishi XL30 ColorView XGA Projector	The Mitsubishi XL30 ColorView XGA projector shines 3,000 ANSI lumens and is the world's quietest running near-silent at 27 db. It offers the first universal remote that also controls a computer mouse and two video devices such as DVD players or VCRs.
Dell—4100MP Projector	Dell's 4100MP Projector, available in Dell's online Higher Education Store, features bright 2200 lumens, a 2000:1 contrast ratio, and multiple PC input. Horizontal and auto vertical keystone, PIP and eco-mode.
Boxlight—XD-25m Projector	The new XD-25m Projector from Boxlight is small in weight and volume—it's about the size of a VHS tape. Multimedia presentation is available because of the video input. There is an on-board speaker. Has 1000 ANSI lumens, 2000:1 contrast ratio, digital computer input, DLP-XGA resolution.
Sharp Electronics—PG-A10S-SL Projector	Sharp Electronics' PG-A10S-SL projector is a multimedia projector that is perfect for the classroom. It is quiet, compact, uses economical power, and works on the PC, Mac, or workstation.
Sony—VPL-CX85 Projector	Sony's new projector, the VPL-CX 85, is a wireless portable projector that can be easily transported between meeting rooms or used as an entry-level install unit. It weighs less than nine pounds.
InFocus—X2 Projector	The new X2 Projector from InFocus has wireless capabilities and is compatible with LiteShow, the secure wireless solution from InFocus. Excellent video quality, with 1500 lumens, 2000:1 contrast ratio, automatic de-interlacing.
3M Multimedia Projector MP8790, XGA	The Multimedia Projector MP8790 features an Optional Wireless / Network Module. This projector as a high light output for a first-rate performance, special whisper mode, and a partial magnification function. Little space is required for installation.
	DIGITAL CAMERAS
Olympus—Stylus 410 Digital Camera	The Stylus 410 Digital Camera has the capability of filming QuickTime movies with audio, one of 10 shooting modes in its Virtual Dial. Ultra-compact, usable in all types of weather, made of metal.
	DISPLAY MONITORS
Gateway—42-inch Ultrabright Plasma Display	Gateway's new Ultrabright Plasma Display Screen features a Display Table Stand, Integrated NTSC Tuner, IR Remote Control, NTSC RF antenna, Composite Video, Component Video (2), S-Video, audio-in (6), audio-out, subwoofer, VGA, DVI In, and RS-232.

PRODUCT GUIDE

A Resource for Technology Leaders in Higher Education

Gateway—50-inch HD-Ready Plasma Display	Gateway's new 50-inch HD (High-Definition)-Ready Plasma Display comes with a Display Table Stand, VGA, DVI In, RS-232, NTSC RF antenna, Composite Video, Component Video (2), S-Video, audio-in (6), audio-out, and subwoofer.
	DOCUMENT CAMERAS
ELMO—HV-100XG Notebook Digital Document Camera	The HV-100XG Notebook Digital Document Camera from ELMO offers XGA capture and output resolution, progressive scan at 20 fps for virtual real-time viewing, and an RGB PC connection for seamless laptop presentation switching.
EPSON—ELPDC04 High-Resolution Document Camera	This high-resolution document camera with true XGA resolution comes with a remote control, tilting camera head, 10x optical zoom lens, and has top lights that can be repositioned.
	ELECTRONIC WHITEBOARDS
CMG—Polyvision LT-6000 Interactive Whiteboard	CDW's Polyvision LT-6000 Interactive Whiteboard offers the precision of laser tracking on a durable ceramic steel surface. It captures anything written or drawn on the whiteboard to your computer so you can print, e-mail, fax, or upload your notes to the Web.
Mimio—MimioBoard Interactive Whiteboard	Mimio's MimioBoard Interactive Whiteboard enhances teaching and learning by allowing students to focus on class materials rather than just copying the notes. Class notes can be instantly printed, e-mailed, or posted to a class Web site.
Polyvision—Walk-and-Talk Presentation Series Interactive Whiteboard	Polyvision, a leading company in innovative visual communications solutions, has a Walk-and-Talk Presentation Series Interactive Whiteboard. Uses software of your choice, through PolyKey technology.
SMART Technologies—Rear Projection SMART Board Interactive Whiteboard 2000i	SMART Technologies' Rear Projection SMART Board Interactive Whiteboard 2000i is a product of DviT (Digital Vision Touch). By touching the large-screen display you can navigate Web sites, and control computer applications.
	PRESENTATION TOOLS
Canon—PR 200S - Presentation Assistant	The new PR 200S Presentation Assistant from Canon shows an immediate display just after a paper document or overhead transparency is scanned.
Extron—MediaLink Controller	The MediaLink Controller, MLC 206 AAP, from Extron mounts anywhere, even on surface mount boxes. Four single-space openings for Extron's Architectural Adapter Plates. Three relays for centralized control of room devices.
JVC—SR-MV30 DVD/S-VHS Dual Deck	Combining S-VHS/VHS, DVD recording and playback in a single unit eliminates the need for multiple components and the complexity of an external wiring.
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SBC	15		www.sbc.com
SMART Technologies	21	(888) 42-SMART	www.smarttech.com/syllabus
Sonic Foundry	45	(877) 783-7987	www.sonicfoundry.com
Sony	37,39		www.sony.com
Stratasys	43		www.dimensionprinting.com/syl
Syllabus	27-30	(800) 795-5228	www.syllabus.com/summer2004
Xythos	33	(888) 4-Xythos	www.xythos/4education

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Campus Enterprise,

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national network infrastructure from Chicago to Seattle through our states. We call ourselves the Northern Tier Network Consortium (NTNC). None of us are the national leaders in building network infrastructure. We are figuring this out as we go along, politically, financially, and technically.

Our colleagues in the northeast corner of the U.S.—New England and upstate New York—are engaged in the same kind of process. The Northeast Research and Educational Network (NEREN) initiative is trying to build great connectivity for that part of the country to the advanced network points of presence in New York City.

We all need to be able to take advantage of the great advancements in computing and networking technology, the great work of scientists and scholars in this country and worldwide. We need to make the learning and discovery process available to students—in the cities and in the remote rural areas. National advanced network infrastructure is one part of the support for that kind of access. Building out the networks in our communities, our states, and our regions is the other critical component. For universities and colleges, this kind of access is critical to our mission.

Annie Stunden (stunden@uwisc.edu) *is chief information officer and director of the Division of Information Technology (DoIT) at the University of Wisconsin-Madison.*

RESOURCES

Northern Tier Network Consortium (NTNC)
www.ntnc.org

Northeast Research and Educational Network (NREN)
www.nren.nasa.gov

Internet2
www.internet2.edu

National Lambda Rail (NLR)
www.nationallambdarail.org.

Future Technologies Forum
www.wiscnet.net

Neptune
www.neptune.washington.edu

BEYOND POWERPOINT,

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content. Another important use of ink is to repurpose slide content, such as changing an example on a slide to make it cover a different situation.

Classroom Presenter is just the first step in using electronic materials in the classroom. The current work on Classroom Presenter is to expand its interaction with student devices. One natural direction is note-taking, where the ink and slides are broadcast to note-taking applications such as Brown University's Remarkable Texts, Microsoft's OneNote, or the Classroom Presenter so that the student can take notes on top of the instructor's ink and slides. Another direction is to provide mechanisms for the instructor to direct student activities. One example that Classroom Presenter supports is student contribution of slides. In this case, students write on slides on personal devices and send them back to the instructor. The instructor then chooses student submissions to display for class discussion. This activity has a number of benefits. It engages the students by giving them an activity to perform in class, instead of just listening to the instructor. It allows the instructor the opportunity to screen submissions before displaying them, to choose ones that illustrate different approaches. And it supports "going to the whiteboard" in a way that everyone can contribute.

Richard Anderson (anderson@cs.washington.edu) *is a professor in the Department of Computer Science and Engineering at the University of Washington.*

*[**Editor's note:** The development of Classroom Presenter began when the author was on sabbatical at Microsoft Research working with the ConferenceXP Project (www.conferencexp. net). The work is now being conducted at University of Washington, with collaborators at University of Virginia and University of San Diego. The software is available for non-commercial use from www.cs.washington.edu/education/dl /presenter/.]*

Reflections,

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can have a profound effect on the outcome of an experiment. A simulation is a simulation. It is never the real world.

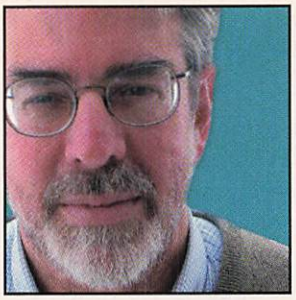
An apprentice develops intuition over many years by trying thousands of ways to do things and learning from his or her mistakes. Some of those *mistakes* produce the serendipity that leads to advances in the field. As Albert Einstein said, "Anyone who has never made a mistake has never tried anything new."

Intuition is what we really hope to develop in our classrooms. Why would we just settle for having a student know the formula for every possible parabola and having him/her ace the advanced placement parabola exam, when what we really want in our students is parabola karma? A student can get parabola karma—or French literature karma, or economics karma—by spending long years as an apprentice or by a few hours, days, or weeks experimenting with an appropriate simulator.

Limitations aside, well-designed interactive simulations allow students to learn not only by doing, but more important by experimenting; exploring the proven, the dead ends, the true, the false, and the unexpected. But college students who have been told for years to do things *right* need to be taught that it is okay to experiment; that their goal is to develop intuition, not to find the one right answer.

While we fuss to improve learning in the classroom and embrace each new instructional delivery system, we need to remember that our goal is not so much information transfer as it is kindling curiosity, enthusiasm, and the desire for knowledge in our students. Einstein skeptically notes that "It is a miracle that curiosity survives formal education." If we use IT to get our apprentices fired up, then they will not only survive formal education, they will flourish.

Howard Strauss (howard@princeton.edu) *is the manager of technology outreach at Princeton University.*



Howard Strauss

REFLECTIONS

ANOTHER LOOK AT EDUCATION TECHNOLOGY

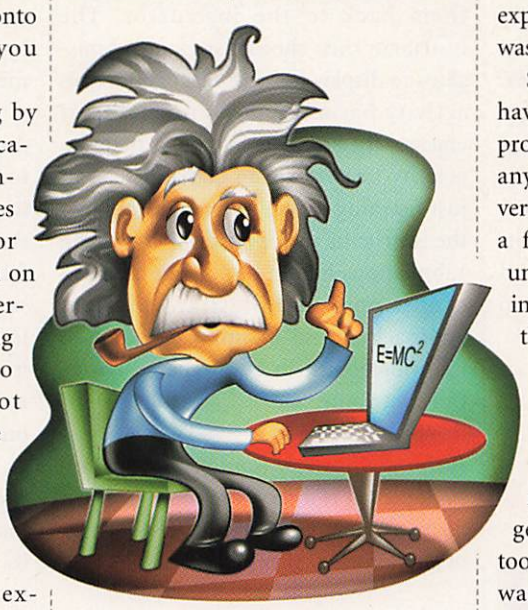
An Academic Apprentice

Once the path to learning a trade or profession was to become an apprentice. Whether you wanted to become a sea captain, silversmith, or doctor, you found specialists in your field of interest and joined them as an entry-level assistant. Over many years, with enough aptitude, determination, and luck you might work your way up to becoming an expert. Eventually you could take on apprentices of your own, passing onto future generations the skills you learned and likely extended.

An apprenticeship is learning by doing the gold standard of education. A thousand days of continuous exposure to PowerPoint slides about sailing is no substitute for actually changing a sail in a storm on a pitching deck. Books and PowerPoint slides might help with sailing theory, which will be easier to absorb when icy waves are not trying to wash you overboard. The combination of theory in class and practice in labs or in the field has been embraced in almost every discipline.

To get a pilot's license, for example, one must spend time in ground school and in actual flight, and as well as passing both a written exam and a flight test. Prospective doctors spend countless hours in class followed by sleepless days and nights in a residency program actually treating patients.

Even for students who will not spend any time in laboratories after graduation, lab work is used extensively to extend knowledge and experience. Labs enable students to *learn by doing* in a controlled environment that is often not possible in the field, without the long-term commitment of an apprenticeship. Labs, however, especially at the undergraduate level, have many shortcomings. Time is always tight and there is often more emphasis on getting the right results than doing any real experimentation. Some things are so difficult to do that they can't be made into simple lab experiments. There are also limitations to what can be done safely in a lab. A student lab, for example, is a bad place to try thermonuclear reactions or grow a new strain of anthrax. And then there are physical limitations to what can be done. Studying a process that takes a long time to occur cannot be done effectively in a lab.



To avoid the limitations of labs yet still achieve learning by doing, simulations are often used. The very best simulations are so good that they may be used as substitutes for the real thing. Excerpted from CEA.com: "Today's commercial flight simulators are so sophisticated that pilots proficient on one aircraft type can be completely trained on the simulator for a new type before ever flying the aircraft itself." And of course when Neil Armstrong set down on the moon, the only previous experience landing the Lunar Module was with simulators.

Simulations are wonderful, but they have limitations, too. I have a simple program that draws regular stars with any number of points by connecting vertices of polygons. Whether you want a familiar fivepointed star or an unusual 55-pointed one, you just key in the number of points and it draws the star. But it accepts every number without question. Ask for a star with -6.39 points and it does the math and draws something that it proffers as correct. A colleague of mine wrote a simulator of complex gears that did not fuss about on e-toothed or fractional-toothed gears and was accepting of an enormous gear fitting inside a tiny one.

Simulations also often assume a level of precision that is not possible. A one-kilogram object in a physics simulator has a mass of exactly one kilogram, though except for the platinum-iridium bar in the custody of the International Bureau of Weights and Measures near Paris, France, the kilograms you use in the field will be a bit bigger or smaller. Small differences

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Illustration by Peter Lacalamita

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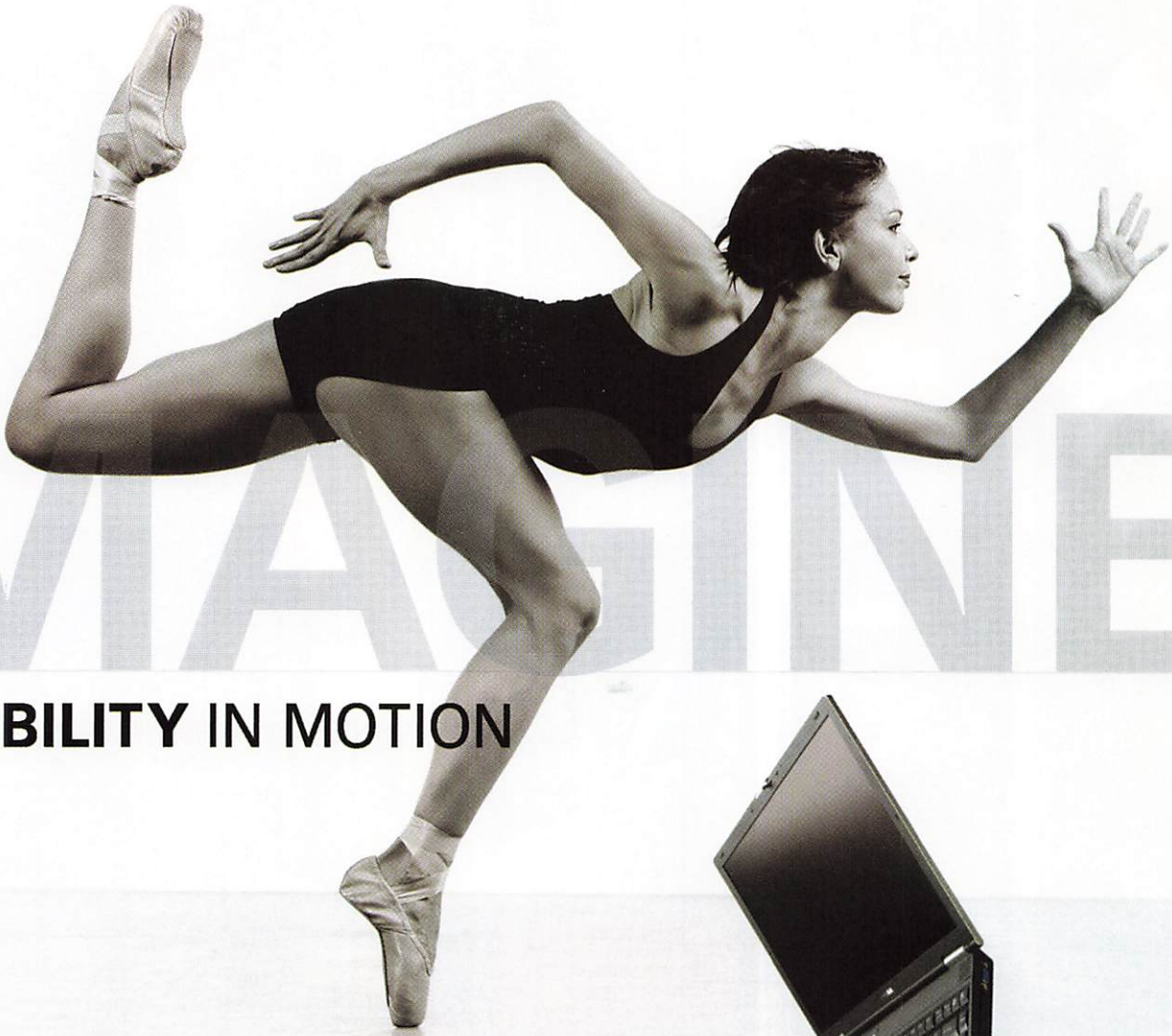

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